THURSDAY, MAY 20, 1875

THE UNSEEN UNIVERSE

The Unseen Universe; or, Physical Speculations on a Future State. (London: Macmillan and Co., 1875.)

THIS book, which rumour attributes to a co-partnery of two distinguished physicists, will at least serve to prove one thing, that scientific men are not necessarily unbelievers, and that some scientific men accept frankly and fully the whole of what is generally understood as the scheme of Trinitarian Christianity, and find in it the most adequate expression of their own physical speculations. Whether their readers agree with or differ from the authors, they cannot fail to recognise the extent of their information and the freedom of their reasoning. There is no attempt to make anything square with preconceived theories, and although we doubt whether the writers would have arrived at their conclusions without the accepted scheme of orthodox Christianity to serve them as a clue, it is equally clear that they rest them on what they think adequate scientific evidence.

The preliminary chapter states the fact of the all but universal belief in, or aspiration after, Immortality. It admits that that doctrine is inconsistent with the doctrine of continuity as generally-understood and as applied solely to the visible universe. It accepts and explains the principle of continuity in the fullest sense, and it attempts to reconcile it, as thus apprehended, with the doctrine of immortality. Incidentally—out of the apparent waste of energy on space, and on other indications chiefly teleological—it constructs a hypothesis of an invisible universe, perhaps developed out of another invisible universe, and so on *ad infinitum.* It is another consequence of the theory that our natural bodies are probably accompanied by a sort of invisible framework or spiritual body, and that the phosphorus and other substances of which the natural body is built up are not really identical with these elements in their ordinary condition of inorganic atoms, but are somehow transubstantiated by the co-existence, along with the mere chemical substance or with its chemical properties, of this invisible, imponderable, immaterial, accompanying essence, which derives a kind of *vis vivida* from a connection with the unseen universe. The passage from the visible universe to the invisible seems to be made intelligible to the authors by the existence of the ether, a substance into which energy is continually being passed, and into which it is perpetually, and, so far as any obvious or sensible effect is concerned, finally, absorbed.

As a first postulate the authors assume the existence of a Creator. Finite beings, creatures, are conditioned by the laws of the universe, and it is in these conditions that we must seek to discover its nature. The first pair of subjects for human thought are matter and mind, and the materialists tell us, that whereas mind or mental activity never exists without being associated with some forms of matter, we may perfectly conceive matter, as for instance a block of wood or a bar of iron, existing without intelligence. Is mind then the dependant—is there nothing in matter which serves as the vehicle of intelligence different from all other matter? The authors answer that we have no right to assume that the brain consists of particles of phosphorus or carbon such as we know these substances chemically, that we cannot say that there may not be something superadded to their chemical and physical qualities. They dwell upon another fact—the fact that individual consciousness returns after sleep or trance; a fact inferring some continuous existence. The assumptions of the materialist are less inevitable than he supposes. Turning to mind, finite conditioned intelligence, the authors ask, what is essential to it? It must have some organ by which it can have a hold upon the past, and such a frame and such a universe as supply the means of activity in the present. Outside they find physical laws, and they look on the principle of continuity as something like a physical axiom. By this principle we are compelled to believe that the Supreme Governor of the Universe will not put us to permanent intellectual confusion. It is in the nature of man, certainly in the nature of scientific man, to carry the explanation of everything back *ad infinitum,* and to refuse perpetually to grant what is perpetually demanded of him, that he has arrived at the inexplicable and unconditioned. On this principle scientific men have supposed themselves to prove that the physical universe must one day become mere dead matter. The authors consider that this is a monstrous supposition, although they grant that the *visible*, or by-sense-perceivable universe, *must in transformable energy, and probably in matter*, come to an end. They think that the principle of continuity itself demands a continuance of the universe, and they are driven to believe in something beyond that which is visible as the only means of explaining how this system of things can endure in the future, or can have endured for ever in the past. They see a visible universe, finite in extent and finite in duration, beyond which, o both sides stretching infinitely forward and infinitely backward, there is an invisible, its forerunner and its continuation. It is natural to infer that these two invisibles must meet across the existing finite visible universe. As we are driven to admit the invisible in the past and in the future, there must be an invisible framework of things accompanying us in the present.

What then is this present visible universe, and can we point to sure signs of this invisible substance which accompanies what may prove after all to be the mere shadow of things? Matter has two qualities. The first is that it is indestructible; the second, that the senses of all men alike point to the same quantity, quality, and collocation of it. Our practical working certainty of the existence of matter means (1) that it offers resistance to our imagination and our will; and (2) that it offers absolute resistance to all attempts to change its quantity. Certain other things—notably energy—are in the same sense conserved, and if we recognise the transmutability of energy of motion into energy of position, we may say that energy is equally indestructible with matter itself. But energy is undergoing a perpetual self-degradation. All other forms of energy are slowly passing into invisible heat motions, and when the heat of the universe has ultimately been equalised, as it must be, all possibility of physical action or of work will have departed. Mechanical effort cannot longer be obtained from it. The perfect heat-engine only converts a portion of the heat into work; the rest is lost for ever as an available source of

work. There is indeed a sort of wild and far-off possibility by which a little more work *might* be got out of a uniform temperature universe, if we could suppose Clerk-Maxwell's demons—"mere guidance applied by human intelligence"—occupied in separating those particles of a heated gas which are moving faster than the average from those which are moving slower. But this is but a broken reed to trust, and it would at the best avail us little. What must happen in the existing physical system would be this: the earth, the planets, the sun, the stars, are gradually cooling; but infinitely numerous catastrophes by which the enormous existing store of energy of position may be drawn upon, may over and over again restore unequal temperature. The fall together, from the distance of Sirius, of the sun and another equal sun would supply the former with at least thirty times as much energy as can have been obtained by the condensation of his materials out of a practically infinite nebulous mass of stones or dust. But these catastrophes can only delay the inevitable. If the existing physical universe be finite—and the authors never seem to realise the speculative possibility that it may not be so—the end must come, unless there be an invisible universe to supplement and continue it.

What is the ultimate nature of matter, and especially of the ether, which is the vehicle of all the energy we receive from the sun? There have been four theories, for each of which something may be said. There is the Lucretian theory of an original, indivisible, infinitely hard atom, "strong in solid singleness;" Boscovich's theory that the atom or unit is a mere centre of force; the theory that matter, instead of being atomic, is infinitely divisible, practically continuous, intensely heterogeneous; and, finally, the theory of the vortex atom, a thing not infinitely hard and therefore indivisible, but infinitely mobile, so that it escapes all force which makes effort to divide it. What we call matter may thus consist of the rotating portions of a perfect fluid, which continuously fills space. Should this fluid exist, there must be a creative act for the destruction or production of the smallest portion of matter. Whichever of these theories we adopt, we must explain the simplest affection of matter—that by which it attracts other matter. There seems little possibility of doing so. The most plausible explanation is in Le Sage's assumption of *ultramundane corpuscles*, infinite in number, excessively small in size, flying about with enormous velocities in all directions. These particles must move with perfect freedom among the particles of ordinary matter, and if they do so we can understand how, through the existence of the ultramundane particles, two mundane particles attract inversely as the square of the distance. On this theory the energy of position is only the energy of motion of ultramundane and invisible particles—and a bridge is built between the seen and the unseen. These ultramundane particles are something far more completely removed from all possibility of sensible qualities than the ether which Sir William Thomson has attempted to weigh. Struve has speculated upon the possibility that it is not infinitely transparent to light, and his calculations, based on the numbers of stars of each visible magnitude, lead him to suppose that some portion of the light and energy from distant suns and planets may be absorbed in it. The ether is thus a kind of adumbration or foretaste of the invisible world. It may have certain of the properties of that world which is perceived by sense, but it is probably subject only to a few of the physical conditions of ordinary matter.

Let us look once more at the substance of the universe. We recognise that it is impossible to suppose any existing state but as the development of something pre-existing. To suppose creation, is to suppose the unconditioned. Creation belongs to eternity, and not to time. This being so, it is difficult to believe in the vortex ring theory, which regards the invisible universe as an absolutely perfect fluid. With an imperfect fluid, the eternity of visible matter which the vortex theory requires, disappears. Such a visible universe would be as essentially ephemeral as a smoke-ring—so that we may accept it as possible, if not probable, that the visible universe may pass away—that it may bury its dead out of its sight. In its present state we have three forms of development—Chemical, or Stuff Development, Globe Development, and Life Development. It is a question whether the ultimate atoms of chemists are really ultimate; whether some agent, like great heat, for instance, could not split them up into various groups of some primal substance like hydrogen. We see the prospect of a similar simplicity in the development of worlds on the theory of Kant and Laplace, which makes the systems of the universe the result of the gradual condensation of nebulous masses. In the end, all the masses of the universe must fall together—in the beginning there can have been no masses, everything being nebulous and discrete, even if ordinary matter be indestructible. The last state and the first state of the visible universe are thus separated from each other by a finite duration. A like simplicity may be reached in the development of life. Darwin has made it at least possible that all life may issue from some primordial life-germ. The complete refutation of the doctrine of abiogenesis—the practical proof that life issues only from life—leaves us still bound to account for that germ. There is no doubt that species develop varieties which may ultimately become distinct species, although there is little indication that the varieties of what was once one species are ever separated like species originally different, by a barrier of mutual infertility. A sufficient length of time might enable us to overcome this barrier. In all our developments—the substance development, the globe development, the life development—we are thus brought, in the end, to a something which we are not yet able to comprehend.

Turning from matter to the phenomena which affect it, we notice one singular set of phenomena in which things insignificant and obscure give rise to great lines of events. A whole mass of water, the temperature of which has been reduced below the freezing-point, suddenly crystallises on the slightest starting motion; a whole series of tremendous meteorological phenomena, such as hurricanes in the Indian Ocean, happen because certain positions of Mercury and Venus affect the sun's atmosphere, causing spots in his, and the condition of the sun affects the earth. Like the complicated series of effects which follow the pulling of the trigger of a gun, the effects are utterly disproportionate to their causes. Man is a machine of this unstable kind—some trivial

change affecting the matter of the brain is all that i needed to set him in motion. May not other beings be capable of touching what we may call the hair-triggers of the universe? Whatever these agencies are, angels or ministering spirits, they certainly do not belong to the present visible universe. The writers examine the sacred records to confirm their speculations.

Thus, then, we have a visible and an invisible universe, and we have processes of delicacy in the former which at least suggest the action on it of agencies belonging to the latter. Let us look at the first phenomenon of the visible universe—the expenditure of energy in it. The sun's energy is issuing in what is apparently waste space just as it is issuing in that portion of space which is filled by our earth. What becomes of the energy—probably far more than half of that which proceeds from it—which proceeds apparently nowhere, speeding on with the velocity of light? Is it absorbed in the ether, and if so, what does the ether do with it? The writers suggest that the ether may preserve for intelligent beings the record of the past. But that seems scarcely sufficient use of the energies spent on it; the more so as the intelligent beings existing in the visible universe will certainly come to an end with it.

"We were led," say the authors, in a passage in which their whole theory is perhaps summed up, "to conclude that the visible system is not the whole universe, but only, it may be, a very small part of it; and that there must be an invisible order of things, which will remain and possess energy when the present system has passed away. Furthermore, we have seen that an argument derived from the beginning rather than the end of things assures us that the invisible universe existed before the visible one. From this we conclude that the invisible universe exists now, and this conclusion will be strengthened when we come to discuss the nature of the invisible universe, and to see that it cannot possibly have been changed into the present, but must exist independently now. It is, moreover, very closely connected with the present system, inasmuch as this may be looked upon as having come into being through its means.

"Thus we are led to believe that there exists now an invisible order of things intimately connected with the present, and capable of acting energetically upon it—for, in truth, the energy of the present system is to be looked upon as originally derived from the invisible universe.

"Now, is it not natural to imagine that a universe of this nature, which we have reason to think exists, and is connected by bonds of energy with the visible universe, is also capable of receiving energy from it? Whether is it more likely that by far the larger portion of the high-class energy of the present universe is travelling outwards into space with an immense velocity, or that it is gradually transferred into an invisible order of things? May we not regard ether or the medium as not merely a bridge between one portion of the visible universe and another, but also as a bridge between one order of things and another, forming as it were a species of cement, in virtue of which the various orders of the universe are welded together and made into one? In fine, what we generally call ether may be not a mere medium, but a medium *plus* the invisible order of things, so that when the motions of the visible universe are transferred into ether, part of them are conveyed as by a bridge into the invisible universe, and are there made use of or stored up. Nay, is it even necessary to retain the conception of a bridge? May we not at once say that when energy is carried from matter into ether it is carried from the visible into the invisible; and that when it is carried from ether to matter it is carried from the invisible into the visible

"If we now turn to thought, we find that, inasmuch as it affects the substance of the present visible universe, it produces a material organ of memory. But the motions which accompany thought will also affect the invisible order of things, and thus it follows, that '*Thought conceived to affect the matter of another universe simultaneously with this may explain a future state*' (see Anagram, NATURE, Oct. 15, 1874)."

Our notice has already extended so far that we shall not follow the authors into their examination of the Scriptures, and of certain Christian hymns in which the sentiments and feelings of the Christian world seem to them to be embalmed. We notice only two of the objections to their system, which they themselves state, and seem to us to fail to refute. It is said that "if energy is transferred from the visible into the invisible universe, its constancy in the present universe can no longer be maintained." The answer is, that this visible universe is not the whole universe, and that the conservation of energy principle is applicable only to the whole universe, visible and invisible together, except under special limitations. The retort is obvious, that in this sense, and except when these special limitations specially and finally remove the difficulty, the principle becomes unintelligible and useless. It is a mere theological dogma to say that what energy perishes in the visible passes into the invisible universe; and the dogma is worthless as a physical principle on which to build any physical reasoning. The other objection is, that the dissipation of energy must go on even in this invisible universe, and the new assumption only delays the inevitable end of all things. The answer made is, that the universe may be regarded as an infinite whole. We have no objection, but the same may be said of the visible universe, and the moment that it is so regarded the arguments on which its end and its beginning are inferred seem to vanish into air. An infinite universe will have an infinite store of energy, and there is no need to suppose that its store is ever exhausted, or that in any finite time it has become practically degraded and unavailable. The whole elaborate machinery of the invisible universe (p. 171), piled one on the top of the other, seems to us to fall like a house of cards, if we can accept the eternal duration of an infinite by-sense-perceptible universe.

The book is written in a simple and persuasive style, with a transparent simplicity and purity of purpose. Once or twice there is an outburst of irrepressible energy, like that on pp. 106 and 107, about wife-beaters, who are to be subjected "by an enlightened Legislature to absolutely indescribable torture, unaccompanied by wound or even bruise, thrilling through every fibre of the frame of such miscreants." But these outbursts are transient, and they relieve the strain on the reader's attention.

THE TIDES OF THE MEDITERRANEAN

Az Arapály Fiumei Oböl ben (*The Tides in the Roadstead of Fiume*). Prize Essay, published by the Royal Philosophical Society of Hungary. By E. Stahlberger, Professor in the Imperial Royal Marine Academy. (Buda-Pesth, 1874, 4to., pp. 109, with plates and copious tables.)

FEW points in physical geography have had more interest for scientific men than the tides of the Mediterranean. Connected with the Atlantic only by a

strait of a few miles in width, this inland sheet of water is so effectually shut off from the general tidal movements of the main ocean, that it has often been called a "tideless sea." But this is not correct; for, having an extent of surface of some 700,000 or 800,000 square miles, it is sufficiently large to be itself specially affected by the attraction of the sun and moon, and thus it possesses a true, although small, tide of its own.

The daily variations in the level of the water have of course been always patent to the dwellers on the Mediterranean coasts; and, no doubt, careful observers must have remarked a periodicity in the recurrence of such variations, identifying them to a certain extent with the ocean tides. But from the small amount of the true periodical rise and fall, and from the large influence of accidental causes, the phenomena have been so irregular as to present great difficulties in their analysis; and, so far as we know, there has not been, down to the appearance of the present work, any systematic investigation of the subject put on record.

The present publication has arisen from a prize of 200*l.* having been offered in 1872 by the Royal Hungarian Society (from funds furnished by Government) for scientific labours bearing on the physical or meteorological conditions of the kingdom of Hungary.

Fiume is a town of some importance, lying on what is called the Hungarian *littorale*, washed by the waters of the Gulf of Quarnero, an irrregular-shaped recess in the extreme north-eastern part of the Adriatic. The Government of Hungary, desirous to promote the maritime interests attached to their little seaport, have established there a Marine Academy, and M. Stahlberger, one of the professors in that institution, had had occasion to make and register observations on the rise and fall of the water in the neighbouring roadstead. Conceiving that by studious labour the phenomena he had recorded might be reduced to something like rule and order, he undertook the elaborate theoretical discussion of them, and the Society, appreciating the value of the work, has not only awarded him the prize for it, but has published it, in full detail, for the benefit of science in general.

The author was led to this investigation by the double object of obtaining accurate information, first, as to the general phenomena of the tides in the Adriatic, or rather in the Mediterranean generally; and secondly, as to the peculiarities in these phenomena induced by local influences in the neighbourhood of the port of Fiume.

He remarks, in regard to the first point, that the semi-mensual irregularity which it is customary to deduce from observations, in order to predict the times of high and low water, is altogether different in the Adriatic from what obtains in regard to the ocean generally; and yet the causes of this difference have never yet been explained.

In regard to the second point, he refers to notices that had appeared of remarkable irregularities in the Fiume tides, which rendered further investigation very desirable. It had been perceived, that instead of the usual six hours' alternating ebb and flow, there was frequently only one high and one low water in the day; and, moreover, that the time of the lowest water advanced on the average two hours every month, or twenty-four hours in a year.

These strange phenomena had attracted attention, and in 1868 the Adria Commission of the Imperial Academy of Sciences at Vienna established a self-registering tide-gauge at Fiume, the control of which was entrusted to M. Stahlberger. The present essay contains the results of three years' observations, which are fully and scientifically discussed by him.

The tide-gauge was on a plan that has often been used in this country. It consisted of a float, which by means of connecting machinery and a pencil made a mark on a sheet of paper stretched on a drum. The drum being moved uniformly by clockwork so as to make one revolution in twenty-four hours, the height of the tide at any time of the day could be deduced by simple measurement from the curve produced on the paper. The same paper was used for three days' observations, the curves being distinguished from each other by different coloured pencils being attached at the beginning of each day.

The author appears to have gone to work in his investigation in a thoroughly philosophical way. He has first collected a very large number of facts, as shown by the records of his gauge; he has then tabulated them with great care and ingenuity, classifying them with special reference to the nature of the influences known to be in operation, such as the positions of the heavenly bodies, the direction and force of the wind, the state of the barometer, and so on; and finally, working on the records thus arranged, he has, by applying scientific calculations of a high order, been able to a large extent to simplify the complicated questions involved, and to throw much light on their explanation.

To facilitate the investigation, he divides the tidal phenomena into two classes: namely, in the first place, periodical motions of the water produced by cosmical causes; and secondly, non-periodical motions produced by the influence of meteorological or local agencies. He then discusses each of these two divisions at considerable length.

As to the periodical motions, he found that in calm weather, and even to a less extent at unsettled times, the figures drawn by the gauge showed unmistakable signs of periodicity; but the appearances were of two kinds: sometimes they showed two well-defined maxima and minima, six hours apart; at other times there was only a single maximum and minimum, sharply defined, these two types melting into each other with all gradations.

These regular forms were clearly to be referred to the periodical motions of the heavenly bodies, and the author, having carefully collected and arranged the facts, enters into a long and full theoretical discussion of their causes, according to the principles laid down by Newton and Laplace.

We cannot pretend to give any details of the laborious mathematical calculations which follow: it must suffice to extract the author's brief summary of his results on this head. He says that the periodical movements of the sea in the Gulf of Fiume depend in the first place on four simple oscillations, two of the sun and two of the moon; and secondly, on four other simple vibrations, two due to each body, which are reckoned in sidereal time, but which have only a slight effect, and may be neglected in computation.

If δ_m and δ_s represent the declinations of the moon and sun respectively, ρ_m and ρ their distances (expressed in terms of their respective mean distances), t_m and t_s the numb

of lunar or solar hours (Mondbeziehungsweise Sonnenstunden) which have elapsed since the last upper culmination of either body respectively; then the theoretical elevation or depression of the sea in the Gulf of Fiume due to these causes for any given time is found in millimetres by the expression :—

$$112{\cdot}1\ \frac{\cos^2\delta_m}{\rho_m^3}\cos\frac{\pi}{6}(t_m-8{\cdot}49)$$
$$+\ 272{\cdot}4\frac{\sin 2\delta_m}{\rho_m^3}\cos\frac{\pi}{12}(t_m-4{\cdot}60)+60{\cdot}3\frac{\cos^2\delta_s}{\rho_s^3}\cos\frac{\pi}{6}(t_s-8{\cdot}57)$$
$$+\ 130{\cdot}4\ \frac{\sin 2\delta_s}{\rho_s}\cos\ \frac{\pi}{12}(t_s-4{\cdot}46)$$

This is the theoretical amount, not allowing for any local retardation, or any influence of the weather.

The author has calculated this for a great variety of conditions of the variable quantities, and compared them with the results of observations, and the comparisons have always been satisfactory.

He gives comparative pairs of curves, one drawn by the tide-gauge, the other calculated by the formula, and the striking resemblance is at once appreciable by the eye. The coincidence would be still nearer if the influence of the small sidereal-time variations were added.

The mean amplitudes of the four chief oscillations are as follows :—

		Millimetres.
For the oscillation of twelve lunar hours	...	103·2
For that of twelve solar hours	...	55·
For that of twenty-four lunar hours	... ...	130·5
For that of twenty-four solar hours	... ...	62·4

The maximum amplitudes are :—

For the oscillation of twelve lunar hours	...	132·8
For that of twelve solar hours	... ...	60·9
For that of twenty-four lunar hours	... ...	272·2
For that of twenty-four solar hours	... ...	100·2

The author shows how the variable combinations of these several elements determine and account for the peculiar phenomena observed, and he explains in what particulars the circumstances at Fiume would appear to differ from those in other places, and to give rise to special phenomena peculiar to that locality.

He further devotes particular attention to the explanation of the singular daily retardation, which he states has also been noticed by M. Aimé on the coast of Algeria, although it had been erroneously ascribed by him to the effect of the wind. The real cause he shows to be the oscillations depending on sidereal time.

The non-periodical motions of the water are caused chiefly by variations in the direction and force of the wind, and in the barometer-pressure. The temperature of the sea rain, and storms, may have also some influence, but too slight to require investigation.

The author therefore confines his attention to the wind and the pressure of the air. In regard to the former, looking at the form and position of the Gulf of Quarnero, it is evident that southerly winds will force the water into the cul-de-sac towards Fiume, and so will raise the level, while northerly winds will tend to drive the water out of the gulf, and so lower the surface.

In regard to the barometer-pressure, it is pointed out that if the weight of the atmosphere at any given part of the sea differs from that at another part some distance away, there must be a corresponding difference in the level of the water; and this difference will be proportional to the specific gravities of the two fluids :—thus a difference in the barometer of one inch of mercury will cause a difference of level of about 13½ inches in the water.

The effects of these two influences are involved in various complications, but they are sufficiently proved by the records, and their amount is shown to be considerable.

The following facts shown in the records will give some general idea of the extent of the Mediterranean tides; we believe they are pretty much the same in all parts of the sea.

The highest water level known was on Dec. 26, 1870, being 0·870 metres above a certain datum point; the lowest was on Jan. 11, 1869, being 0·482 metres below the same point. Hence the greatest difference of level experienced was 1·352 metres, or about 4½ English feet.

The average daily variation of level was 0·583 metres, or nearly two feet English; the greatest daily variation was 0·825, and the least 0·259 metres.

The mean daily variation of level is the same, whatever be the absolute general level of the water; as is natural, seeing that the latter is influenced by local circumstances that have no effect on the attractions of the sun and moon.

The mean high and mean low water stand at equal distances above and below the average mean level.

The author modestly expresses the opinion that his own three years' observations are of too limited extent to determine fully the values of all the influences which affect the tides, and he recommends that before the investigation is carried further, accurate observations should be made at other points of the Adriatic Sea, in order that, by a combination of such data, the distinction between normal and exceptional phenomena may be more positively defined. No doubt such an extended inquiry would give results of great value to physical science, and M. Stahlberger's excellent example is not unlikely to stimulate others to co-operate in such an undertaking.

The book is well got up. It is written in the national language, but there is also given a translation into German, and the data, in the form of tables, are so full and complete as to enable anyone to verify, by his own examination, the conclusions arrived at by the author.

OUR BOOK SHELF

Cambridgeshire Geology; a Sketch for the use of Students. By T. G. Bonney, F.G.S., Tutor and Lecturer in Natural Science, St. John's College. Cambridge: Deighton, Bell, and Co., 1875.)

MR. BONNEY's short sketch of the geology of the neighbourhood of Cambridge will be a useful handbook to those students who wish to become practically acquainted with the geological features of the country round their temporary home. It makes no pretensions to be an exhaustive description, and happily is not written in a style suitable for cramming, but simply draws the attention of the careful reader to all the interesting points in connection with the geology of the district, and notices the various contributions to fact or theory made by previous writers, embodying many of Mr. Bonney's own observations. The first deposits described are the Oxford clay of St. Ives and the Elsworth rock, the true position of which latter is discussed; and then follows a notice of

the coral reef at Upware, and the Kimmeridge clay at Ely. We have next a discussion of the coprolite and associated beds at Potton and Upware, which Mr. Bonney considers Upper Neocomian, and he thinks most of the fossils derived. After a short notice of the Gault comes a full discussion of the interesting questions connected with the so-called Upper Greensand. An admirable outline of its palæontology is first given, and the origin of its phosphatic nodules is then concluded to be analogous to that of flint, or what is here called concretionary action. With regard to its age, Mr. Bonney follows Mr. Jukes-Browne in considering it homotaxial with the chloritic marl, and a large part of its fossils derived from the Upper Gault. The chalk is dismissed with a very short notice, and an account of the Post Pliocene deposits concludes the sketch. These deposits are described under six divisions, the lowest being the true Boulder Clay. The most interesting of these is the "Fine Gravel of the Plains," which has yielded so many mammalian remains. Five appendices follow: on Upware sections, the Ely pit, the Hunstanton red rock, the water supply, and building stones of Cambridge. The second of these might well have been omitted, for though it refers to an interesting case of a large chalk boulder, we are now sufficiently familiar with such instances of huge transported rocks to make it waste of time to discuss imaginary systems of impossible faults to account for its presence in some other way.

Journey across the Western Interior of Australia. By Col. Peter Egerton Warburton, C.M.G. With an Introduction and Additions by Charles H. Eden. Edited by H. W. Bates. With Illustrations and a Map. (London: Sampson Low and Co., 1875.)

COL. WARBURTON well deserves any honours which he may have received; for the sake of increasing knowledge he has performed as bold a feat of travel as is on record. With his son, Mr. J. W. Lewis, two Afghan camel-drivers, and two natives, he set out on April 15, 1873, from Alice Springs, in E. long. 133° 53′ 14″, S. lat. 23° 40′, about 1,120 miles north from Adelaide, and travelled right across the centre of the Australian continent, reaching the western side in January 1874. Col. Warburton's narrative in the book before us consists of the record which he kept day by day of his progress. The party had sixteen camels, and were provisioned for six months. Experience has shown that to explore Central Australia camels alone are of any use, horses being totally unable to bear up against the universal scarcity of water, and the bristling spinifex stalks which cover the ground almost everywhere, and which cut their legs to pieces. Col. Warburton's journal, not long after the start, becomes a painful record of a daily hunt after water, a hunt which was often unsuccessful. During the greater part of the journey man and beast were in a chronic state of parching thirst. The country crossed over is as arid and desolate a wilderness as can well be conceived, consisting mainly of low sandy hills covered almost everywhere with the above-mentioned spinifex, occasionally varied by a salt marsh, a few hills, and rarely a few trees. Indeed, the whole country from 121° to 131° E. long. is one great sandy desert. Bustards, one or two species of pigeons, owls, rats, a small species of kangaroo, swarms of torturing flies and ants, were met with, the last-mentioned with painful frequency. Natives were also seen, and they proved perfectly harmless and generally shy, and some of them Col. Warburton describes as handsome and well made.

The general method of procuring water was to scoop out wells in the sand, and it was only at long intervals that suitable places occurred. The food supplies of the party were very soon exhausted, and they had for the greater part of the journey to live on roots, an occasional "wallaby" (small species of kangaroo), and on the camels which they were compelled to kill. Of the fourteen camels, only two reached the journey's end, some having been lost, some left behind as unable to move, and seven killed for food. The flesh of the latter seems to have been as tough and devoid of nourishment as leather, and by the time the party reached the welcome river Oakover they were all nearly on the point of starvation; latterly, Col. Warburton himself had to be tied on his camel's back. On reaching the Oakover, some of the party pushed on to the settlement for relief, which at last came, and Col. Warburton met with an enthusiastic reception everywhere from Roeburne to Perth and on to Adelaide. He has made a valuable contribution to our knowledge of Central Australia, and as the spirit of exploration seems to be thoroughly aroused in the colony, we may hope soon to have its geography at last filled up. The difficulties and dangers of Australian exploration are well known, and by forethought and organisation no doubt they might be successfully met. It seems doubtful whether any economic use can ever be made of the arid wastes of Central Australia, but a thorough knowledge of its natural history and geology would be of high value from a scientific point of view. All the expenses of Col. Warburton's journey, we should say, were generously borne by the Hon. T. Eden and Mr. W. W. Hughes, public-spirited Australian colonists.

The introduction occupies about one-half of this volume, and consists of a carefully compiled and most interesting *résumé* of Australian exploration from Eyre's daring journey in 1840 downwards; it adds much to the value of the work. Mr. Bates has discharged his editorial duties satisfactorily. A good portrait of Col. Warburton is prefixed, and the map gives one an excellent idea of the route as well as of the nature of the country. The other illustrations are rude but interesting. Altogether the volume is a valuable contribution to the history of Australian exploration.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Acoustic Phenomenon

PERHAPS the following description of a phenomenon in sound which I have frequently observed may be of some interest to a few of your readers:—

If an observer is placed a short way, say about eight yards, in front of a straight palisaded fence made with deals of about three inches in width and about six inches from centre to centre apart, so as to leave intervening spaces of three inches, and then gives a smart clap with his hands, or, what is better, with two flat pieces of wood, a peculiar echo is heard almost at the same instant.

The nature of the sound is neither that of a true musical note nor of an inflection; it appears to the ear to be somewhat intermediate to those, inclining more at the beginning, when well elicited, to a very high-pitched sound of the latter kind; it slides down until it becomes a distinctly audible musical sound at the end, if the fence is 80 or 100 yards long; with those dimensions a moderately quick ear can easily recognise the pitch of the final note to be near D on the fourth line of the treble clef.

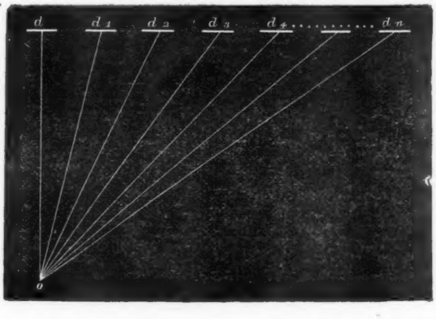
The phenomenon is caused by each board of the fence giving rise to a resonance; those aërial impulses succeed each other at constantly increasing intervals of time, and with such a degree of rapidity as to constitute a continuous sound of the kind which is here described. The vibrations will be seen, from the following diagram, to be neither isochronous like those of a musical sound, nor to vary in their periods in the same simple order as those of an inflection which is produced by sliding the bridge of a monochord while it is vibrating.

Let o be the position of the observer, and $d\ d_1\ d_2\ d_3$ &c. the boards of the fence.

Call the distance $o\ d = D$, and $d\ d = \delta$. Then by the common rule for right-angled triangles the distances of each board from the observer are respectively $\sqrt{D^2}$, $\sqrt{D^2 + \delta^2}$, $\sqrt{D^2 + 4\delta^2}$,

$\sqrt{D^2 + 9\delta^2}$; the reflected sounds which reach the observer will travel double those distances.

D $(D^2 + \delta^2)$ $(D^2 + 4\delta^2)$ &c., being integral quantities, and δ positive, the series will be an increasing one; hence the first impulse which is heard is that produced by d, and the last one that by d_n.



Twice the difference between any term and that which immediately precedes it will be the length of the sound-wave corresponding to that term, and the velocity of sound per second, divided by the wave-lengths, gives the relative pitches of the different impulses.

The wave-lengths corresponding to $d\, d_1\, d_2$ &c. are—

$$2(\sqrt{D^2 + \delta^2} - D);\ 2(\sqrt{D^2 + 4\delta^2} - \sqrt{D^2 + \delta^2});$$
$$2(\sqrt{D^2 + 9\delta^2} - \sqrt{D^2 + 4\delta^2}) \text{ \&c.} \qquad \text{(I.)}$$

And calling V the velocity of sound per second, we get the relative pitches—

$$\frac{V}{2(\sqrt{D^2 + \delta^2} - D)};\ \frac{V}{2(\sqrt{D^2 + 4\delta^2} - \sqrt{D^2 + \delta^2})} \text{ \&c.}$$

Now, if the observer removes close up to the fence, the distance D becomes an indefinitely small quantity, or zero, and the series (I) for the wave-lengths becomes $2\sqrt{\delta^2}$; $2(2\sqrt{\delta^2} - \sqrt{\delta^2})$; $2(3\sqrt{\delta^2} - 2\sqrt{\delta^2})$; $2(4\sqrt{\delta^2} - 3\sqrt{\delta^2})$, &c., or 2δ, 2δ, 2δ, &c.; that is, the wave-lengths are all equal, and a musical sound is heard. In practice, an ordinary fence does not yield a sufficiently loud note to be easily heard in this case, but one made with posts having intervening spaces of about five inches gives a good result when one stands four or five feet from it, the note comes out almost perfect. By taking different values for D we have from series (I) a corresponding change of wave-lengths, so that if a row of persons are placed from o to d, each will hear a sound which is different in pitch from that heard by all the others.

It is perhaps needful to state that the sound which has been described is completely masked if there are houses or a wall a few feet behind it, or if the place of observation is a road fenced with palisades on both sides, two sounds are produced which interfere and confuse each other.

Glasgow ANDREW FRENCH

The Degeneracy of Man

THE numbers of NATURE for June and July last, which have lately reached me (vol. x. pp. 146, 164, 204 and 205), contain a correspondence on the subject of the degeneracy of man, in connection with which I wish to contribute a few remarks.

I have nothing to say on the original point introduced by Mr. E. B. Tylor. But, during my residence in the islands of the Pacific, I have given some attention to the general question of degradation or progression, as exhibited in the Polynesians. The result is, that I believe there are numerous indications of the degeneracy of these people from a higher social and intellectual level than that which they at present occupy. I could not give in detail, in this letter, the entire evidence on which this opinion is based; I will therefore briefly mention two or three indications only of this degeneracy which I have noticed.

The language of the Polynesians furnishes one of these. While there is much in it which shows a low moral tone, there are, on the other hand, many refinements (a large proportion of which are known to most of the present generation) which I do not believe could have been invented, or gradually developed, by the race in its present intellectual condition. Their old traditional stories, and their ancient poetry also, are so different from anything the present Polynesians are capable of producing, that I often think (your classical readers will please pardon the comparison) the relative difference, between the past and present, is as great as that between the intellect of the Greeks, in the period of the highest Attic culture, and those of the present century. I have often asked men of more than average intelligence, why their modern compositions are so inferior to many of the old ones. They invariably reply that the men of old were greater and wiser than those of the later generations.

The industrial and ornamental works of the Polynesians are all, I believe, of ancient origin. Their houses, their canoes (with one exception), their fine mats, the way in which they make their bark cloth, and even the patterns which they print on it, are all according to the traditional forms handed down from generation to generation. There is no originality. Invention is unthought of. Even now, when the influence of external civilisation is brought to bear with considerable force upon them, they adopt a new idea very, very slowly. If they had never been in a higher and more active intellectual condition, I cannot conceive how they could possibly have obtained the many comparatively excellent customs, the—in many respects—elaborate language, and the advanced social customs which were in their possession when first they became known to the civilised world.

I am well aware that absolute proof of the degeneracy of the Polynesians will not, by any means, render necessary the conclusion that degeneracy has been universal with the human race. Advocates of the progressive theory do not deny that some instances of degradation are to be found. In his "Primitive Culture" (vol. i. p. 34) Mr. Tylor says: "Of course the progression-theory recognises degradation, and the degradation-theory recognises progression, as powerful influences in the course of culture." Hence I present the indications of degeneracy above-mentioned as, at most, only a minute portion of the cumulative evidence which must be adduced indisputably to prove the degradation-theory of general application to the human race.

Apropos of this question I may add, that I often think much of the difference between (at least the more moderate) progressionists and degradationists is owing to the want of a clear definition of the term *civilisation* as used on either side. One appears to me to think chiefly of a *material civilisation*, while the other thinks mainly of a *moral civilisation*. I do not believe in the evolution of man from a lower form of life. But, notwithstanding this, I doubt whether the first man was *civilised* in the ordinary sense in which that word is now used. So far as a material civilisation goes, I take him to have belonged to the earliest stone age. But at the same time I feel the strongest conviction that he was, in point of moral civilisation, immeasurably in advance of a savage. It has often been said by advocates of the degradation-theory that no well-authenticated instance has ever been given of a savage who has, apart from external help, improved his condition. I believe this assertion to be true, notwithstanding Sir John Lubbock's "Cases in which some improvement does appear to have taken place," given in the appendix to his "Origin of Civilisation" (pp. 376-380). I do not deny the force of the reply to the above assertion, given by advocates of the progression-theory; viz., that it is almost impossible to *prove* that a savage race has, unaided by external influence, bettered its condition. But from personal observation of savage and semi-savage life, I feel almost certain that a real savage is utterly incapable of, in any way, raising himself. He lacks the sensibility which must serve as a fulcrum for the lever which is to lift him. Upon this ground alone, if I had no other reason for it, I should doubt whether man had, unaided, developed himself from a state of unmitigated savagery.

Upolu, Samoa S. J. WHITMEE

The Law of Muscular Action

IN NATURE vol. xi. p. 426, my esteemed friend Prof. Hinrichs does me the honour to comment on my paper published in NATURE, vol. xi. pp. 256 and 276.

He claims to have found that in lifting a weight w until exhaustion sets in, the number of lifts n is represented by the equation—

$$\left.\begin{array}{ll} & n = \dfrac{A}{B^w} \\ \text{or} & \log. n = \log. A - w \log. B_1 \end{array}\right\} \qquad (1)$$

where A and B are constants.

That the relation between n and w (the strength of the muscle

remaining constant) is a logarithmic function was plainly indicated in the last paragraph but one in my second paper in NATURE, p. 277. In my paper in the *American Journal of Science*, Feb. 1875, p. 130, a formula was given at the close of the paper, p. 137, which is equivalent to Hinrich's formula (1), calling τ the time of exhaustion (or number of lifts), and s the strength of the muscle obtained with a dynamometer, and

$$\tau = \alpha (s - \beta)^v \qquad (2)$$

where α and β are constants. If the dynamometer gave the real strength in kilograms, β would equal w. In the series published in NATURE, s was obtained in another way, there described, and β was zero (nearly); v is a function of the weight. So that Hinrichs' formula does not seem to differ essentially from (2). In giving this formula, I stated expressly that I did not wish to discuss this equation at present, as the constants had not been determined with satisfactory precision. I take this occasion to repeat that statement.

Another point to which it may be well to call attention is, that in exhausting the arm with heavy weights very little pain is felt. With light weights, however, the pain is very great.

Our knowledge of this whole subject is yet so fragmentary, and the subject itself is so complex, that we can only hope to represent our knowledge by empirical formulæ. The best service is to be rendered in the direction of careful experiment. I shall therefore devote a few years to the work outlined in my paper in the *American Journal of Science*.

Washington University, F. E. NIPHER
St. Louis, Mo., April 28

Physiological Effects of Tobacco Smoke

Is Dr. Krause (NATURE, vol. xi. p. 456, vol. xii. p. 14) acquainted with the manner in which cascarilla bark modifies the physiological effects of tobacco smoking? The addition of a few very small fragments of the bark can hardly be supposed to materially affect the amount of carbonic oxide produced; and yet, with such an admixture, the strongest tobacco may be smoked by a tyro without, in most cases, the production of the usual nauseating effects. Loss of appetite, thirst, vascular and nervous depression are sometimes produced if such a mixture is smoked in excess. On the other hand, if Dr. Krause's theory, that the nausea, &c., of tobacco smoking is due to the carbonic oxide inhaled, be admitted, the question is suggested whether some of the volatile products of burnt cascarilla bark are antagonistic in their physiological action to the gas in question? C. E. S.

OUR ASTRONOMICAL COLUMN

NEW VARIABLE STAR (?).—Mr. J. E. Gore, of Umballa, writes with reference to a star of about the 6th magnitude noticed on the 13th of January about 1° north, following θ Leporis, and not having found it in Harding's Atlas or in Lalande, or the B. A. C., he supposed it might be a new star. "It is of a reddish colour, and is in the same low-power field with, and about 25′ north of (a little preceding) the 7m. star Lalande 11778 . . . It is closely followed by two small stars which formed with it a curved line." From this description the star is evidently VI. 58 of Weisse's first Catalogue, observed by Bessel early in 1825, and estimated 6·7 magnitude, the small stars preceding it being Nos. 68 and 78 of the same hour. It is not found in D'Agelet, Lamont, or in any other catalogue we have examined, of previous date to that accompanying Heis's Atlas, where it is entered 6·7, but erroneously identified with VI. 78 of Weisse's second Catalogue, instead of VI. 58 of his first. (The large number of similar errors in Heis's references is a serious defect in a work otherwise of so much value.) Mr. Gore mentions that he had not remarked, up to the middle of April, any variation in the star's light, but it evidently requires further examination, and may yet appear on our rapidly extending list of variables.

THE BINARY STAR ζ HERCULIS.—If good measures of this star are obtained during the present season, we may expect to know the elements of the orbit with considerable precision. Dunér's results, founded upon measures 1826-69, will be the best so far published, but he did not regard them as definitive; they will no doubt be very useful in any further investigation, and for this reason are here subjoined:—

Peri-astron passage 1864·23

Node	45° 56′	Excentricity ...	0·42394
Node to peri-astron on orbit ...	250 50	Semi-axis ...	1″·223
		Period	34·221 yrs.
Inclination ...	34 52		

PETERS' ELLIPTIC COMET 1846 (VI.).—This comet, which was detected at Naples on the 26th of June, 1846, by Dr. Peters, now Director of the Observatory at Clinton, New York, was calculated by Prof. D'Arrest, and in a more complete form by the discoverer himself, who, in a memoir published in the Transactions of the Naples Academy in 1847, found the time of revolution 12·85 years, but with an uncertainty of ± 1·61 years; in a subsequent communication to Brünnow's *Astronomical Notices*, he gave elements for 1859, including the effect of perturbations of the planet Saturn, which, however, he shows to be liable to very considerable doubt, on account of the observations in 1846 being insufficient to fix the mean motion at perihelion in that year within narrow limits. It is to be remarked that in 1846 the comet appeared under nearly the most favourable circumstances possible for observation, and at the time of discovery the comet was distant from the earth less than 0·6 of our mean distance from the sun, yet Dr. Peters found it very small and faint, and unless the perihelion passage should happen to fall about the same time of the year as in 1846, it might be exceedingly difficult, if not impossible, to recover it. The only hope of doing so is in keeping a close watch in the late spring and early summer, upon those parts of the sky indicated with different suppositions for date of perihelion passage, say from May 15 to June 15, which are wholly in south declination, a circumstance that will render the assistance of observers in the other hemisphere very desirable. To give an idea of the comet's track in the heavens when the perihelion falls in May, we assume the 15th and 25th for the passage by this point of the orbit, and thus have the following positions:—

	In perihelion, May 15·0.			In perihelion, May 25·0.		
	R.A.	Decl.	Distance	R.A.	Decl.	Distance
May 15...	256°·5	50°·0 S	0·594	228°·8.	55°·8 S	0·600
„ 25..	256 ·5	42 ·2	0·552	231 ·1	48 ·4	0·561
June 4...	255 ·9	32 ·8	0·538	233 ·4	39 ·2	0·546
„ 14...	255 ·3	23 ·1 S	0·555	235 ·8.	29 ·4 S	0·564

The least distance between the orbits of the earth and comet is about 0·53.

Considering the uncertainty in the mean motion deduced from observation in 1846, it is quite within possibility that a perihelion passage may occur as late as the summer of the present year, and it may be worth while to institute a search upon that supposition.

MINOR PLANETS.—No. 26, *Circular zum Berliner Astronomischen Jahrbuch*, just issued, contains new elements and an ephemeris of No. 114, Cassandra, and corrected ephemerides of No. 71, Niobe, and No. 128, Nemesis. The period of revolution assigned to Cassandra for November 1872 is 1598·5 days. Several of this group are now adrift, the elements not having been determined with sufficient approximation to keep them in view. The planet found by Borrelly at Marseilles, 1868, May 29, and that detected by Pogson at Madras on November 17 in the same year, are thus situated; both travel beyond the limits of our ecliptical charts, which contain very small stars.

OUR BOTANICAL COLUMN

THE PANDANEÆ.—A fine series of Pandanus fruits has recently been received at the Kew Museum from Mr. John Horne, of the Botanic Garden, Mauritius

These fruits form the first consignment of a quantity collected in Mauritius and Seychelles by Mr. Horne for transmission to Kew, as material for the *Pandaneæ* in the forthcoming Mauritius Flora, and will form a valuable addition to the Museum collection. The fruit-heads of the *Pandaneæ*, like the cones of the *Piceas*, are very difficult to preserve entire except they be kept in fluid, and even then, if they are gathered too ripe the single drupes are apt to separate from the central axis. Those just to hand from Mr. Horne are the best set ever received at Kew, inasmuch as they appear to have been carefully selected and gathered before they were too ripe, wooden tallies with numbers *cut* in them firmly fixed upon each specimen with copper wire, and the whole sown up tightly in stout sacking or canvas and placed at once in rum. In this way the collection contained in five small barrels arrived in perfect safety at Kew, where the specimens, after being taken from the spirit and the canvas coverings cut away, were securely enclosed either in a network of thin copper wire or fine strong cord and gradually dried. We mention these facts because travellers and collectors too frequently send home specimens of Conifers, Cycad cones, or others of a similar nature simply rolled in paper or packed in sawdust; in the one case they dry and fall to pieces immediately upon opening, while in the other the sawdust absorbs moisture, and the fruit or cone simply rots and becomes quite worthless. Another advantage in sending woody fruits like the *Pandani* in fluid in the manner above described, is that they can be removed, dried, and mounted on wooden stands, by which they are more convenient for examination, and occupy much less space, and are manifestly more economical both for public and private collections than when preserved in large glass jars in alcohol. The collection, numbering some twenty-three heads of fruits, sufficiently illustrates the variety of form and size in the different species, the largest being some thirteen inches through, and the smallest not more than two inches. Mr. Balfour, who accompanied the Transit of Venus Expedition to Rodrigues, has also paid special attention to the *Pandaneæ*, and his collections, preserved, we believe in a similar manner, have recently arrived in this country.

SANTAL VERT.—Under the name of *Santal Vert*, or false sandal-wood, a dark green, close-grained wood, somewhat like *Lignum vitæ*, may occasionally be seen in wood collections. The origin of this wood is not generally known, but it seems to be the produce of an Euphorbiaceous plant, probably a species of *Croton*. The bulk is obtained from Madagascar, and some from Zanzibar. It is generally supposed, however, to be the produce of Zanzibar, probably on account of that from Madagascar passing by way of Zanzibar in course of transit to India, to whence it is mostly shipped, chiefly, it is said, for the purpose of burning the bodies of Hindoos, as it fetches a much lower price than the true sandal-wood. The wood of the *Santal Vert*, though small, is sometimes used in Mozambique for furniture. A species of *Croton* found by Dr. Kirk on the Zambesi produces a similar wood; indeed, it may be identical.

SOME RESULTS OF THE "POLARIS" ARCTIC EXPEDITION

IN a letter to the French Geographical Society, published in the March *Bulletin*, Dr. Bessels, the principal scientific member of the *Polaris* Arctic Expedition, rebuts some of the statements published by Mr. Tyson, and gives some of the scientific results which were obtained. The position of the Observatory, obtained from many varied observations, was 81° 38′ N. lat., 61° 44′ W. long., and thirty-four feet above sea-level. Many careful observations were made on the tides, in meteorology, magnetism zoology, botany, geology, and with the pendulum, in order to determine the force of gravity. Unfortunately, in the catastrophe which happened to the ship, many of the results of these observations were lost; nevertheless, enough was saved to afford a fair idea of the physical geography, the geology, the fauna and flora of the region visited. Dr. Bessels is preparing a detailed account of the results obtained, and we believe has given much valuable information for the use of our own Arctic Expedition.

The pendulum observations are specially precise and valuable. The magnetic observations are more complete than any hitherto made in the polar regions. The observations on declination were made every hour for five months, and during three days in each month every six minutes. The western declination was found to be 96°, and the absolute declination 84° 23′.

The observations on the tides were made with very great care, generally every hour, and for three or four weeks every ten minutes, in order to obtain the precise moment of the flux and reflux. High water occurs about every 12h. 13m.; the highest flux observed was 8 feet; the lowest reflux, 2·5 feet; mean of high and low tide, 3·8; mean of spring tide, 5·47; mean of neap tide, 1·83. Other hydrographical observations comprehend soundings, temperatures at various depths, and detailed observations on the specific gravity of the water.

After having entered Smith Sound, a current was observed running southwards, the rate of which varied from 1·5 to 5 miles. This current carried with it much driftwood, all the specimens of which seen by Dr. Bessels were coniferous, with very close ligneous layers, indicating that the specimens came from a cold climate.

The greater part of the meteorological registers were saved, embracing observations on the temperature of the air and on barometric oscillations, anemometric and hygrometric results, observations on terrestrial and solar radiation, on polar auroræ, and on ozone.

The fauna and flora of Hall's Land are very rich, but unfortunately nearly all the specimens collected were lost. Eight species of mammals were observed, twenty-three kinds of birds, fifteen species of insects, and seventeen species of plants. Of the mammals, *Myodes, spr.* (Pallas) and *Ovibos moschatus* (Zimm.) were found in West Greenland for the first time. The greater part of the insects are Diptera, of which one species is new.

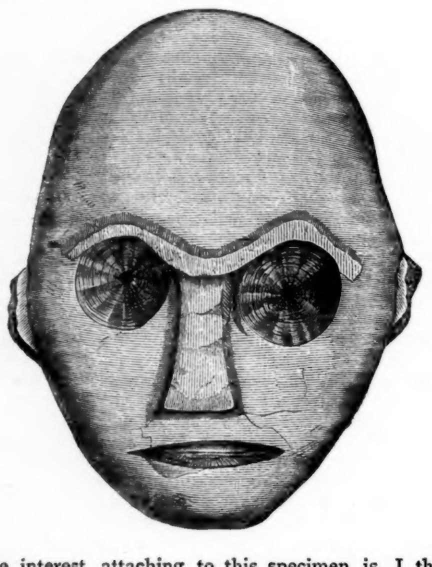
Although the geological formation of Polaris Bay and its neighbourhood presents only Silurian limestone, containing few fossils, yet some very interesting observations were made. At elevations of 1,800 feet, not only was driftwood found, but also shells of molluscs (*Mya*, &c.), of species which still exist in the neighbouring seas. On examining some of the small lakes which abound in the region, marine crustaceans were found to be living in these fresh waters. This is certain evidence of the gradual elevation of the coast of this part of Greenland.

Wherever the country is not too steep, large numbers of erratic blocks are met with, of a kind quite different from the rocks on which they rest. There are blocks of granite, gneiss, &c., from South Greenland, and these blocks have evidently been borne, not by glaciers, but by floating icebergs; a proof that at one time the current in Davis Strait had a different direction, and passed from south to north. Dr. Bessels believes that Greenland has been separated from the American Continent in a direction from south to north.

ON THE OCCURRENCE OF A STONE MASK IN NEW JERSEY, U.S.A.

THE occurrence of stone "masks," such as the specimen referred to, has been somewhat frequent, in and about the "mounds" of the Ohio and Mississippi Valleys, but not eastward of these localities. Somewhat more

elaborate carvings of the human face have been found in Western New York, figures of which are given in the Thirteenth Annual Report of Regents of New York State University. These may or may not be of identical origin with the western mound specimens. The specimen here figured is, I believe, the only one ever found in New Jersey. It is a hard sandstone pebble, such as are common to the bed of the Delaware River, above tide water. It measures six inches in length by a fraction over four inches in greatest breadth. It is concavo-convex, the concavity being shallow and artificial. The carving of the front or convex side is very rude, but shows distinctly that it has been done with *stone tools* only. The eyes are simply conical counter-sunk holes, rudely ridged, and just such depressions as the stone drills, so common among the surface relics of this neighbourhood, would produce. In the collection of stone implements from Central New Jersey, at the Peabody Academy of Salem, Mass., are several drills sufficiently large to bore as wide and deep depressions as the "eyes" of this mask. The nose is very flat and angular; the mouth merely a shallow groove. The ears are broken, but appear to have been formed with more care than any other of the features. The chin is slightly projecting.



The interest attaching to this specimen is, I think, twofold, and worthy of a moment's consideration. It is interesting from the fact of being found in New Jersey, a point much further east than the mound-builders have been supposed to reach, and there is no reason to suppose that the specimen was ever brought by white men from the west, and lost here. The circumstances connected with its discovery render such a supposition untenable. Its interest, otherwise, is in the fact (as I suppose it) of its being a true relic of the mound-builders. The mystery of this people has certainly yet to be solved, if, indeed, it ever can be, and the relationship they bore to the "Indian" determined. In the prosecution of my investigations into the "stone-age" history of the New Jersey Indians, I was continually struck with the great resemblance of the stone-implements found in New Jersey to those found in the western mounds. The specimens figured by Messrs. Squier and Davis, in the first vol. of Smithsonian Contributions, 1847, were all, or nearly so, duplicated by specimens I gathered in New Jersey; and up to the time of the completion of my second paper on the Stone Age of New Jersey (now in press), I needed but "animal pipes" and stone masks, such as the above, to make the duplication of the mound-relics complete. The occurrence of this specimen brings it to the one form of pipes, and that such have occurred in New Jersey is highly probable; but not having gathered such a specimen, myself, I assume that none have yet been found. It must be borne in mind, however, that as there are no mounds in New Jersey, animal pipes, if found here, must occur as surface relics, or in graves; which latter were, as a rule, very shallow. As New Jersey has been settled for about two centuries, it is probable that such animal pipes would be gathered up, when found, and soon again lost or destroyed, when ordinary "relics" would be overlooked. In this way, such animal pipes would have all disappeared, perhaps a century ago, when their value as archæological specimens was unknown. This, too, might account for the great rarity of such specimens as the mask here described.

CHAS. C. ABBOTT

Trenton, New Jersey, U.S.A., April 22

*FERTILISATION OF FLOWERS BY INSECTS**

X.

Lilium Martagon.

C. SPRENGEL was the first to turn his attention to the structure of the beautiful flowers of this plant; † but he did not succeed either in observing insects visiting them or in explaining the contrivances by which they are cross-fertilised when visited by suitable insects. Since Sprengel's time nobody had, as far as I know, studied the manner of fertilisation of *Lilium Martagon*. It was, therefore, with great pleasure that, in Thuringia, I examined the structure of its flowers, and watched them in their natural habitat. The results of my observation were as follows.

Along the middle of each sepal and petal, beginning at its base and continuing throughout a length of 10-15 mm.,

FIG. 63.—Flower of *Lilium Martagon* in its natural position and natural size.

is a furrow, which secretes honey, and whose margins converge and are bordered with reddish knobbed hairs, so close as to cover the open side of the furrow, and to convert it into a channel (*h*, Figs. 63, 64). The basal opening of this channel (*b*, Fig. 64) being closed by the base of a filament, the only way by which the honey is attainable is the small opening at the end of the channel (*e*, Fig. 64). This opening, as well as the channel itself, is very narrow, its diameter only a little exceeding 1 mm. No other insects except Lepidoptera are provided with sucking instruments sufficiently long and slender to be able to reach the honey concealed in these long and narrow channels; and from the flowers being turned downwards and the stamens projecting and slightly bending upwards, it is evident that Lepidoptera, when sucking this honey, cannot avoid dusting their under-side with pollen, and effecting cross-fertilisation as often as they fly to another

* Continued from vol. xi. p. 171.

† C. Sprengel, "Das entdeckte Geheimniss," &c., pp. 187-189

flower and bring their pollen-covered under-side first in contact with the stigma, which slightly overtops the anthers. The flowers of *Lilium Martagon* must consequently be considered as adapted to cross-fertilisation by Lepidoptera.

The colour of these flowers, dark reddish brown, with dark purple dots on the inside, is not very striking, and in the daytime they are but slightly scented, whereas during the evening they emit a very attractive sweet odour. Hence we may safely conclude that they are far more attractive to crepuscular and nocturnal than to diurnal Lepidoptera.

Thus far, in Thuringia, in July 1873, I had succeeded in explaining the separate peculiarities of the flowers; but in vain had I watched them repeatedly during the evening in order to surprise the fertilisers in the very act of fertilisation. But the hope I had failed in when making every effort to realise it, happened to be fulfilled a year later, quite unexpectedly. In the Vosges, returning from the Hoheneck, and passing the village Metzerall, July 5, 1874, towards the evening, I was struck with the sight of flowering plants of *Lilium Martagon* growing in a garden hard by, and a specimen of *Macroglossa stellatarum* flying round them and fertilising them.

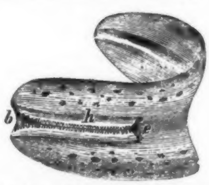


FIG. 64.—A single sepal or petal of this flower, magnified.

Freely fixed in the air by the rapid movement of his wings, this busy Sphinx inserted his long slender proboscis into the honey-channels of the sepals and petals, now of a single one, now of others of the same flower, and having done so immediately flew away to another flower. Yet, the flowers never being turned directly downwards, but somewhat inclined, all the honey-channels of any flower were never sucked by the Sphinx, but in every case only those of the uppermost sepals and petals. When sucking he always touched the stigmas and the anthers with his legs and under-side, and the latter ones were to be seen rocking and swinging. Thus, undoubtedly, the under-side of the Sphinx was dusted with pollen, and the stigma of the flower next visited, when first touched by the pollen-covered under-side, was cross-fertilised. A single Sphinx, with his vehement movements during a quarter of an hour, may easily visit and cross-fertilise plenty of flowers of *Lilium Martagon*. Nevertheless, self-fertilisation in many of these flowers will occur, where visits of Sphingidæ are wanting. For the stigma, by being bent upwards more decidedly than the anthers, comes frequently into contact with one or two of them; and C. Sprengel, who enclosed the yet unopened flowers of *L. Martagon* in a net, thus excluding all insects except some ants (and perhaps Thrips), was surprised to find that every capsule developed and matured its seeds.

Lippstadt HERMANN MÜLLER

NOTE ON THE HYRCANIAN SEA

THE resolution of the problems which are involved in the physical aspects of Western Turkestan, and which have offered so ample a scope for speculation, will probably be one of the earliest and most important consequences of the occupation of the banks of the Amú Darya by Russia. But, whatever may be the light which will thus be afforded to geographers, ethnologists, or historians, it is to be expected that the field of inquiry will widen and recede, in proportion as each step forward is made, along paths which have hitherto been shrouded in obscurity.

Among the observations which will demand, and which will most certainly fully repay, the greatest attention, are those which shall accurately determine the true rate of evaporation from the surface of Lake Aral. A meteorological observatory was established in June 1874 on the lower courses of the Amú, and its working will contribute much to a knowledge of the rate of local evaporation. It may be doubted, however, whether such observations as are recorded at Núkús will be of practical value for determining the desiccation going on in Lake Aral itself. In the absence of precise information we shall for some years be dependent upon data of doubtful trustworthiness, in regard to the aspect the lake may have presented at different epochs in past history.

Among such data there is an isolated observation which seems worthy of more attention than has hitherto been given to it. Between the years 1848 and 1858 Boutakoff found that the depth of water at the entrance of Abougir (the gulf at the south-west corner of Lake Aral, which is now entirely dry) had decreased by eighteen inches, or, in other words, at the rate of 0·05 yards per annum. This rate of decrease may possibly be not very exact; but it is approximately so, and may therefore serve, until better data are available, to draw some conclusions regarding the Aralo-Caspian Sea.

The chart of Lake Aral, compiled from the surveys of 1848-49, shows the waterspread to be about 24,500 square miles. The contour line drawn at a depth of twenty-four feet on this chart includes an area of about 18,300 square miles, *i.e.* the loss of surface is 6,200 square miles. For every yard of fall below its surface of 1848, Lake Aral, down to a depth of eight yards, loses a waterspread of 775 square miles. And since during the past twenty-seven years the surface has fallen $27 \times 0{\cdot}05 = 1{\cdot}35$ yards, the waterspread of 1875 will be $24500 - 775 \times 1{\cdot}35 = 24500 - 1046{\cdot}25 = 23453{\cdot}75 = 23454$ square miles, say. The mean of the two waterspreads of 1848 and 1875 will be $\frac{24500 + 23454}{2} = \frac{47954}{2} = 23977$ square miles, or 74,271,155,200 square yards; and this quantity multiplied by 0·05 gives 3,713,557,760 cubic yards as the volume of water lost by Lake Aral yearly since 1848, or a loss of 120 cubic yards per second.

The supply poured into Lake Aral by the Amú and by the Syr can only be guessed at, since it has probably fluctuated during the past twenty-seven years. At the present time the combined volume afforded by those two rivers may be taken at about 2,000 cubic yards per second; and this estimate is probably not ten per cent. removed from the actual truth. The evaporation, then, from the lake must be assumed to have been, since 1848, $2000 + 120 = 2120$ cubic yards per second, from a waterspread of 23,977 square miles, or 74,271,155,200 square yards, which is equal to an evaporation of 0·0026 yards per diem $= 0{\cdot}0936$ inches per diem, or thirty-four inches per annum.

The physical aspects of the shores of Lake Aral suffice to show that in very recent times its level has been at least fifty feet higher than that of to-day. With this increased depth the waterspread would be about 36,500 square miles, or 113,062,400,000 square yards. The daily evaporation from this surface at 0·0026 yards will be 293,962,240 cubic yards, or 3,400 cubic yards per second. There was therefore a time (and that a recent one) when Lake Aral received a supply of 3,400 cubic yards per second; and, indeed, of more than that quantity. The Russian knowledge of the country, handed down by the great map of the sixteenth century, informs us that a river flowed from the Aral to the Caspian. The geographical MS. of (according to M. Vámbéry) Ibn Said el Belkhi, notices in the early part of the tenth century, the opinion that the two seas communicated; and this com-

munication could, and almost certainly did, take place in the following way.

The crest of the spur of the Ust Urt plateau, which formed the southerly limit of the now desiccated gulf Abougir, is about fifty feet above the present level of Lake Aral. Once filled up to that level, if the lake continued to receive more water than was evaporated from its surface, *i.e.* more than 3,400 cubic yards per second, an overflow would take place into the country now traversed by the channel called Uzboy, which has a gentle slope to the south of less than four inches per mile.* It is probable that the lands stretching from Uzboy westwards to the foot of the elevations encircling Karaboogas would have been flooded. Perhaps at this high level Aral may have discharged at its extreme north-western point also, and have flooded the country stretching round the northern foot of Ust Urt. On the north, it may have topped the low transverse ridge which now divides the northern and southern drainage. And if, in addition, the level of the Caspian was at that time some few feet higher than it now is, its waterspread would have advanced to meet the overflow from Aral, and Ust Urt and its narrow southern spurs, which run along the east shore of the Caspian, would have been isolated among marshes and shallow water. The classical geographers would thus have had ample grounds for the description they have handed down to us of the Sea of Hyrcania, as well as good reason for giving but a single name to the waterspread of the sea, since the separation of its basin from that of Aral would have become evident only after the fall of the level of this lake.

Until the separation became evident, this Aralo-Caspian Sea would have presented all those aspects which history tells us it has had. As the level gradually fell in Lake Aral, the inundated ground would become dryer; and in the first century of our era, as reported by the Chinese, the banks of the "Western Sea" would have been surrounded with great marshes. It may be doubted whether the Palus Oxiana of Ptolemy and the Oxian Marsh mentioned by Ammianus Marcellinus should be placed in this locality; but there is more probability that the Sinus Scythicus of Mela is identical with Lake Aral and its former southern marshy appendage, of which Uzboy is the axis.

The waterspread of such an Aralo-Caspian Sea would have added an area of about 70,000 square miles to the limits of the Caspian of to-day; and the evaporation from such a surface would have absorbed a supply from the rivers then feeding Lake Aral of about 7,000 cubic yards per second; in other words, a volume of water three-and-a-half times greater than that discharged by the mouths of the Amú and the Syr together at the present time.

If it be considered that at this epoch the greater, if not indeed the entire volume of the Oxus passed directly westwards into the Caspian, the difficulty is somewhat increased in finding an answer to the important question, where the large volume of water mentioned came from?

However, it is very probable that the Tchuy and the Sary Su discharged at that time into Lake Aral, instead of losing themselves, as they now do, in the sand. The Kenderlik of the great Russian chart, as well as the Demous, the Baskatis, and the Araxetes of the classics, together no doubt with many other minor streams, have disappeared in these countries, though their waters formerly would have fed Aral. Their disappearance seems to have been contemporaneous with the desiccation of the Oxus branch of the Caspian, at an epoch when those irruptions of Mongol hordes from the north-east were taking place, which swept away early Central Asian civilisation, and which subsequently caused the destruction of the Greco-Bactrian Monarchy. Whether this ruin of ancient social culture was accompanied by the destruction and wreck of a system of hydraulic works which were necessary for the cultivation of the soil, is a question whose answer possibly bears very nearly on the causes of the desolation which Nature now wears in the countries of Western Turkestan.

HERBERT WOOD

* See NATURE, vol. xi. p. 231.

THE HOUSE OF COMMONS EXPERIMENTS ON ANIMALS BILL

THE Bill for the prevention of cruelty in experiments on animals, made for the purpose of scientific discovery, prepared and brought forward by Mr. Lyon Playfair, Mr. Spencer Walpole, and Mr. Evelyn Ashley, is of a very different character from that introduced by Lord Hartismere in the House of Lords and commented on in our last issue (NATURE, vol. xii. p. 21). In it no legislative interference is proposed in the case of operations performed for scientific purposes under the influence of anæsthetics, provided that the insensibility is continued throughout the experiment; immediately after which the animal is to be killed if it has been in any way seriously injured. In the case of operations performed on animals in which it is impossible to employ anæsthetics, it is proposed that those who wish to conduct them shall be required to obtain a license authorising their undertaking them, to obtain which from the Secretary of State a certificate must be produced signed by one at least of the following persons, viz.: the President of the Royal Society, or the Presidents of the Royal Colleges of Physicians or Surgeons of London, Edinburgh, or Dublin; and also by a Professor of Physiology, Medicine, or Anatomy in Great Britain. In the case of the applicant being himself one of the just-named professors, or an authorised lecturer on the same subjects, such a certificate is not to be required, but in its place his application would have to be signed by the registrar, president, principal, or secretary of the university or college with which he is connected. The license requires renewal each five years, except in the case of professors, with whom it lasts during their tenure of office. It extends to any person assisting the holder of the license, provided that the person assisting acts in the presence and under the direction of the holder of the license.

The penalty proposed for any contravention of the Act is a fine not exceeding fifty pounds, or imprisonment for a term not exceeding three months.

The whole tenour of this Bill is so much in accordance with our own feelings that we can say nothing against it. Physiological operations on the lower animals, when conducted under the full influence of anæsthetics, cannot shock the most sensitive-minded; and supposing the Bill passes, it will be in the power of all to see that nothing of a painful nature is undertaken. No definition of what is meant by pain is given, it is true; and the only improvement we can suggest is that one be added which prevents the employment of curare as an anæsthetic until its pain-killing power is demonstrated.

BALLOONING AND SCIENCE

THE number of aëronautical ascents in France has been greatly increased since the *Zenith* catastrophe attracted public notice to aërial questions. On Sunday, the 9th of May, not less than three different balloons went up in different places.

These ascents took place at Ivry, close to Paris, at 5.30, at Nantes at 5.40, and at Algiers at 3.45. In the three cases the balloonists experienced a change in the direction of the wind, varying greatly with altitude. The general direction of the Nantes balloon was south-east. The Paris balloon had a less velocity with a greater number of circuits, having ultimately run a distance of ten miles in two hours. The greatest velocity of the air was in close vicinity to the earth; this is an indication of a special current probably pro-

duced by the warming action of the sun on the solid surface exposed to its rays. These special currents, although somewhat dangerous in making a descent, die out at an altitude of a few hundred feet. The superficial current experienced in the Algiers ascent was running eastwards, and was really a marine current produced by the vicinity of the sea. A peculiarity of this ascent was the presence of a fog, observed at a certain distance above the earth, in air which was coming from the water and had been rendered humid when crossing the Mediterranean Sea. The thermometer, which was only 23° centigrade on the ground, ascended gradually to 25°, and gave 38° and 40° when the balloon had traversed the fog. The maximum observed was 43° at a small altitude.

Clouds do not always prevent the rays of the sun from warming the atmosphere below to a certain extent. In an ascent executed at Avignon (Vaucluse) on the 6th, the thermometer exhibited a warming effect of 5° C., although the balloon had not passed through the clouds, which were at an elevation of more than 4,000 feet.

I do not think we should depend entirely for our knowledge on such points to elaborately organised ascents. As much of our knowledge of the sea has been obtained from the log-books of trading vessels, so by a little good management on the part of aëronautical societies, much important information concerning the atmosphere might be collected from balloonists who make ascents either for purposes of pleasure or profit.

W. DE FONVIELLE

NOTES

M. ANDRÉ, the head of the French Transit Expedition to New Caledonia, has arrived in Paris. His account of the observations will be read to the Academy on Monday week. Dr. Janssen is not expected to arrive in Paris before the 10th of June.

DR. HOOKER was present at Monday's sitting of the Paris Academy of Sciences, of which he is a correspondent in the section of Botany. M. Frémy, the president, noticed the fact, and Dr. Hooker was warmly received by all present.

WE remind the Fellows of the Royal Society of the Reception on the 26th inst., at their rooms in Burlington House, to which they have been invited.

INFORMATION has been received at the Admiralty, by telegram, stating that the *Challenger* will not visit Vancouver Island as intended, but will proceed to Nagasaki, Honolulu, and Valparaiso. Letters should be addressed to Honolulu until the middle of July, and after that date to Valparaiso.

THE French Aëronautical Society has elected for its president M. Paul Bert, the physiologist, who recently organised the fatal *Zenith* expedition. M. Bert has never ascended in a balloon, and has refused several times to do so. M. Tissandier, who had experienced so narrow an escape in the *Zenith*, was appointed one of the vice-presidents.

THE Spectacle Makers have resolved to confer the freedom of their Company on Sir George B. Airy, K.C.B., F.R.S., &c., Astronomer Royal.

WE learn from the Australian papers that an expedition for the exploration of New Guinea is being fitted out by Mr. Macleay, a wealthy citizen of Sydney. Important scientific results are expected to be gathered by this expedition, and Mr. Macleay is worthy of praise for devoting his wealth to so important an object. Notwithstanding that so many explorers are and have been on the island, there is a great deal yet to be done ere we can have anything like an adequate knowledge of its people, its physical condition, and natural history. We hope Mr. Macleay's expedition will attack a part of the island not hitherto explored, and add much that is new and valuable to our knowledge of a country so interesting in itself and in relation to the past of Australia.

THE Swedish Arctic Expedition to Novaya Zemlya, which will start at the beginning of next month from Tromsöe, will be occupied first with botanical, geological, and ethnological inquiries in the southern part of Novaya Zemlya, and then advance along the west coast to the northern point, which it expects to reach about the middle of August. Thence it will go to the north-east to explore this still quite unknown part of the Polar Sea, and then southwards to the mouths of the Obi and the Jenisei, where the country is geologically very interesting. If the ice creates no obstacles, Prof. Nordenskjold will here quit the vessel, and go in a boat up the river, to return home afterwards by land.

THE February number of the *Proceedings* of the Asiatic Society of Bengal contains the President's Address. Colonel Hyde, among other important and interesting topics, refers to the scheme for providing Calcutta with a Zoological Garden, which, through various untoward circumstances, has been hitherto frustrated. The value of such an institution in Calcutta, if put on a rational footing, both to the European and native communities as well as to science, is undoubted, and we hope with Colonel Hyde that the scheme will have the attention both of the Imperial and Local Governments. Indeed, we believe that the Lieutenant-Governor of Bengal has taken up a piece of land suitable for the purpose. The question of the establishment of a Zoological Garden at Calcutta has been before the public and the Asiatic Society from time to time during the last thirty-five years, and it does seem strange that the capital of India should have been so long without such an institution.

ANOTHER subject referred to by the President in the above address is that of earth-current measurements, a committee in connection with which has been appointed at the suggestion of Mr. Schwendler. Considering the very great importance of research in this direction, "there can be no doubt," to quote the Calcutta *Englishman*, "that the Government of India would be fully justified in promoting the undertaking, just as it has assisted the observations of the Transit of Venus, of eclipses, and of meteorological phenomena."

AN unprecedented contest has taken place at the Académie Française in filling the seat vacated by the recent demise of M. Guizot. After four scrutinies, the election was postponed for six months. M. Dumas, the perpetual secretary of the Academy of Sciences, was a candidate, and had as an opponent M. Jules Simon, the former Minister of Public Instruction, an influential member of the Academy of Moral Sciences. But a third candidate, M. Laugel, the scientific reviewer of the *Temps*, and the private secretary of the Duc d'Aumale, having been proposed by his patron and voted by him throughout the four scrutinies, no result could be obtained, the nominations being only made on an absolute majority. M. Laugel has written a few philosophical essays on scientific matters, and is a man of knowledge, but is not known except to a limited circle of friends.

IT is said that thirty young Chinese belonging to influential families are expected very shortly in Paris, where they are to be educated. They are under the care of a French naval officer, who, having joined the Chinese navy, has been appointed Director of Fow-chow Arsenal.

M. LEVERRIER has presented to the Academy of Sciences the observations on the transits of small planets made during the last three months at Greenwich and at Paris: the two Observatories are working conjointly in this department. Observations, limited to those asteroids which are near their apposition, have been made on twenty-two small planets; but the weather was so bad at both Observatories that only sixty-nine observations are recorded, sixty at Paris and nine at Greenwich. Generally the proportion is greater in favour of English observers, but the clouds were dreadfully against them during the last quarter.

WE are informed that Mr. Chadwick, M.P., brought with him from California, on his recent visit, a box of superior Californian silkworm eggs. We understand that he is anxious to distribute them to anyone having a supply of mulberry-leaves and wishing to cultivate them. The eggs have been entrusted to Mr. Loose, the secretary of the Chamber of Commerce, Macclesfield, from whom small quantities can be obtained on application. Mr. Loose has also prepared a few simple instructions for feeding and keeping the cocoons.

THE number of candidates at the recent General Examination for Women at the University of London was thirty-five. Of these, twenty have passed, viz., seven in honours, twelve in the first, and one in the second division.

PROF. J. SACHS, of Würzburg, is engaged in the preparation of a History of Botany, which is expected to be ready for publication in the course of the present year.

IN answer to a request made by the Paris *Figaro*, M. Dumas has given the following details of the alleged effective remedy against Phylloxera:—All remedies discovered up to the year 1874 had the disadvantage that while destroying the obnoxious insects they did considerable harm to the vine itself; the experiments lately made with sulpho-carbonate of potash were, however, perfectly successful, as they do not effect the vine in the least; they were made by M. Milne-Edwards, Du Chartre, Blanchard, Pasteur, Thénard, and Boulay, in different wine-growing districts, particularly in the environs of Avignon, Cognac, Montpellier, and Geneva. The sulpho-carbonates are strewed on the ground, the next rain helps them to penetrate the soil, and the Phylloxera are completely destroyed by them. These salts at present are still rather expensive, but in the districts where the Phylloxera have only just appeared a very small quantity is sufficient, and it is hoped that if Government undertakes a larger production of the salts, the price will be considerably reduced.

THE new Reptile House in the Jardin des Plantes, Paris, has sustained some heavy losses. A large turtle died from the shot it had received many months ago when captured in the Atlantic Ocean, and a large serpent from a wound inflicted by a rat. The rat having been offered as living food, resisted violently, and bit his adversary so deeply that he died a few days afterwards. The warders in the picturesque Reptile House will probably be more cautious in future in showing visitors the spectacle of Ophidians running after their food.

WE are glad to say, however, that the above heavy loss will be to a considerable extent compensated, as the Jardin des Plantes will receive in a very few days a Boa more than eight yards in length, which has just arrived at Havre. We believe it takes a goat or a sheep to appease its appetite at one time.

A GEOGRAPHICAL Society has been established in Roumania under the patronage of the present Prince. A great want has been felt of such an institution, not a single original work having been written by Roumanians on the geography of their native land. All geographical school-books are merely translations of foreign works, and are all full of errors, even as regards Roumania.

A CORRESPONDENT of the *Pharmaceutical Journal*, Mr. G. C. Druce, suggests whether *Saxifraga tridactylites* is not a carnivorous plant. He states that the glands on the leaves present a very similar appearance to those of *Drosera*, and secrete a viscid fluid on being irritated. In a large number of plants which he examined he found the *débris* of some insect attached to the leaves.

THE second of a series of industrial exhibitions projected by the Manchester Society for the Promotion of Scientific Industry was opened at Cheetham Hill, Manchester, on Friday last. The present show has been arranged for the special encouragement of appliances for the economy of labour.

A LARGE deposit of amber has been discovered in the Kurische Haff, near the village of Schwarzort, about twelve miles south of Memel. It had been known for many years that amber existed in the soil of the Kurische Haff, from the fact that the dredgers employed by Government for the purpose of clearing away the shallow spots near Schwarzort that impeded navigation had brought up pieces of amber, which, however, were appropriated by the labourers; and no particular attention was paid to the matter till recently. Some speculative persons, reports our Consul at Memel, made an offer to the German Government, not only to do the dredging required at their own expense, but also to pay a daily rent, provided the amber they might find should become their own property. The proposal was accepted, and the rent fixed at twenty-five thalers for each working day. The dredging was commenced by four machines, worked by horses, which have increased in number and efficiency till eighteen other dredges and two tug-boats, with about 100 lighters or barges, employing altogether 1,000 labourers, are now engaged in the industry. The ground covers an area of about six miles in length, and a yearly rent of 72,200 thalers is paid by the company to the Government.

A NEW species of a new genus of serpents, collected by Lieut. Wheeler's expedition in Arizona during the field season of 1874, has just been identified and named by Prof. E. D. Cope. It is called *Monopoma rufipunctatum*. The rostral shield of this new genus resembles that of *Phimothyra*, and the lateral head shields those of *Cyclophis æstivus*. It is, however, more like *Eutænia* in general character. This is a very interesting discovery.

FOR some time past the United States steamer *Fortune*, commanded by Commander F. M. Green, has been engaged in the Gulf of Mexico and the West Indies, under the direction of the Hydrographic Office, in determining the latitude and longitude of certain points connected by submarine telegraph. Those so far decided are Panama, Aspinwall, Kingston, Santiago de Cuba, and Havana, in each of which places a portable observatory and astronomical instruments were set up, and numerous observations made. The longitudes were determined by the exchange of telegraphic signals, and the latitudes by the zenith telescope observations. During the course of this work numerous soundings were taken, and a very extensive series of specimens of the sea-bottom brought up. These have been submitted to Prof. Hamilton L. Smith, of Hobart College, Geneva, New York, who finds among them many new species, and others previously considered as very rare, and scarcely met with since their description by Prof. Bailey and others.

THE Manchester Field Naturalists' Society issues a very modest Report for 1874, from which it seems that the Society is doing quiet, steady, satisfactory work; "the working members of the Society have steadily extended their knowledge, and latent taste for Natural History has been fostered and developed." This Society is a field club, and during 1874 had twelve successful excursions, interesting reports of which are given by Mr. F. J. Faraday.

ANOTHER Manchester society, and one that really deserves honourable mention, is that known as the Manchester Scientific Students' Association. From its Annual Report for 1874 it is evident that the Society does much good work in which a comparatively large proportion of the members take part. Their frequent excursions are not mere pleasure-trips, as, besides a leader, a lecturer is appointed, who generally takes up a parti-

cular subject and illustrates it from the observations and gatherings of the day. During the winter meetings are held for the reading of papers, many of which seem of considerable value. This Society was formed for the practical study of science, and on the whole this object appears to be well kept in view.

THE Cambridge Board of Natural Science Studies announce that applications by members of the University desirous of availing themselves of the facilities for study at the Zoological Station at Naples during the ensuing season, are to be sent to Mr. Foster, Trinity College, on or before the 20th of October.

AN appeal is made on behalf of the widow of the late Dr. Beke: that lady, it seems, having been left in very straitened circumstances. It is proposed to utilise the Beke Testimonial Fund for this purpose, and additional subscriptions are requested to be paid to Messrs. Cox, Biddulph, and Co., Charing Cross, or to Messrs. Robarts, Lubbock, and Co., Lombard Street.

WE would draw the special attention of our readers to an excellent new quarto work, abundantly and beautifully illustrated, on "The Marine Mammals of the North-western Coast of North America, together with an account of the American Whale-Fishery," by Capt. Charles M. Scammon. It is published at San Francisco by J. H. Carmany and Co. The figures of the characteristic attitudes of the different species of seals, as well as of the whales, in their native element and otherwise, are far superior to any we have ever seen, having all been evidently taken from the life. The volume is dedicated to the memory of Louis Agassiz.

PROF. SHALER has published a memoir upon the "Antiquity of the Caverns and Cavern Life of the Ohio Valley," in which he endeavours to show the period at which the animal life, so characteristic of Western caverns, received its first expression. He sums up his researches in the following propositions:—1. The extensive development of caverns in the Ohio Valley is probably a comparatively recent phenomenon, not dating further back than the latest Tertiary period. 2. It is doubtful whether there has been any extensive development of cavern life in this region before these caverns of the subcarboniferous limestone began to be excavated. 3. The general character of this cavern life points to the conclusion that it has been derived from the present fauna. 4. The glacial period, though it did not extend the ice-sheet over this cavern region, must have so profoundly affected the climatal conditions that the external life could not have held its place here in the shape we now find it, but must have been replaced by some Arctic assemblage of species. Under the circumstances, it is reasonable to suppose that most, if not all, the species found in these caves have been introduced since the glacial period. 5. We are also warranted by the facts in supposing that there is a continued infusion of "new blood" from the outer species taking place, some of the forms showing the stages of a continual transition from the outer to the inner form.

THE additions to the Zoological Society's Gardens during the past week include a Campbell's Monkey (*Cercopithecus campbelli*) from West Africa, presented by Capt. Damm; a Lesser White-nosed Monkey (*Cercopithecus petaurista*) from West Africa, presented by Mr. John Gordon; a Sloth Bear (*Melursus labiatus*) from Ceylon, presented by Mr. W. D. Wright; two Antarctic Skuas (*Lestris antarctica*) from the Kerguelen Islands, presented by the Rev. A. Eaton; a Proteus (*Proteus anguinus*) from the Adelsberg Caves, presented by Capt. R. F. Burton; a Persian Gazelle (*Gazella subgutturosa*), two Coatis (*Nasua nasica*), born in the Gardens; two Wapiti Deer (*Cervus canadensis*) from North America, an Ocelot (*Felis pardalis*) from South America, a Hoffmann's Sloth (*Cholopus hoffmanni*) from Panama, deposited.

ARCTIC MARINE VEGETATION

NOW that another expedition is about to sail for the Arctic regions through Davis's Straits, it is thought that some notice of the magnificent flora of the shores of Greenland may prove interesting. An essay on this subject,* written in Swedish, by Professor Agardh, the celebrated Swedish algologist, is now before me, but as it is too long for insertion in these pages, I will endeavour to condense as much of it as possible into an abstract.

During the Swedish Expedition to Greenland in 1870, a collection of Algæ was made on the Greenland coast, between Disco Island and Sukkertoppen, some degrees to the southward. These Algæ were afterwards examined by Professor Agardh, and in the essay above mentioned he gives us the result of his examinations, and some exceedingly interesting observations upon the characteristics of the marine flora of this Arctic district. It is not only the more or less numerous species which give to the marine vegetation in different zones a different character, but it is the abundance or scarceness of Algæ, their divarication in a greater or less degree from the common form and aspect, their great size, the multitude of individuals, and so on, which give a very variable appearance to the seaweed-grown shores of different seas.

As in the northern region of the pine-tree, there are but few species, while the masses of forest are formed of an immense number of individuals which grow near together; so with regard to the northern marine flora, the principal portion of which is found to possess a general character, consisting of a few similar species, but, as before mentioned, of an immense number of individuals. Nearest to high-water mark are the species of Fuci; below them are the Laminariæ (Tangles, or seaweeds); these crowd on every rock and stone, and to each of them is attached its peculiar parasitic species. Occasionally, other species, belonging to the northern marine flora, stray into calm bays, inclosed caverns, or are carried away by strong currents. Compared with the weed-covered shores of Southern Europe, the uniformity of aspect on these Arctic shores is very great, and the number of species occurring there fewer than those of our own coasts. The principal characteristic of the vegetation of the colder seas is the gigantic size of the species of which it is composed, and this is especially the case with regard to the northern Algæ. *Laminaria saccharina* and *L. digitata*, *Himanthalia*, *Alaria*, *Scytosiphon filum*, &c., on our own coast, give but a feeble indication of what the more Arctic regions in this respect exhibit. When it is known that the Mediterranean and warmer seas contain some few species which from their great size are never found in Herbaria, one can understand how difficult it must be to find specimens suitable for Herbaria among the Arctic species. Professor Agardh lays great stress upon the importance of collecting specimens of these plants in all stages of their growth, and points out the great similarity to each other of young plants of different species, which makes it extremely difficult to discriminate the different species in the young state. The numerous examples, of all ages, brought home by the Swedish expedition, and especially those laid down in salt, could thus be examined in a fresh state, and enough of them might be dissected for the more accurate determination of these large-growing species. As Professor Agardh has referred here to salting down the Algæ, it may be as well to mention that in another publication he has stated that the best way of preserving Algæ is by the following process. In a cask or other convenient vessel put a layer of salt, then a layer of Algæ; then another layer of salt, then another of Algæ, and so on until the cask is full. Algæ thus preserved are found to be almost as fresh as when first taken out of the sea.

If in the extreme north the phanerogamous flora is characterised by dwarf forms, so do forms of an opposite character prevail in the marine vegetation of the Arctic regions. To a certain degree the aspect of the magnificent Arctic marine vegetation depends upon the common large-growing Laminariæ, which constitute a considerable and characteristic portion of it. Laminariæ are also found in the Southern Ocean, and there are even other large Algæ, as, for example, the species of Iridæa, in the North Pacific, which have much larger dimensions in colder oceans than have analogous species in the warmer seas. So, also, the great number of species of Laminaria in the Arctic seas is an indication

* Bidrag till kännedomen af Grönlands Laminaricer och Fucaceer af J. G. Agardh, inlemnadt till K. Vet. Akad. den 27 Sep. 1871. (Stockholm, 1872, P. A. Norstedt and Söner.)

that if these prevail the number of other species is relatively less. While, on the other hand, only one species of Laminaria with an entire, and one with a laciniated frond, is found on the Swedish coast, there are on the coasts of Spitzbergen and Greenland at least five species of Laminaria. The *L. cuneifolia* of Greenland is about the same size as *L. saccharina*; but *L. longicruris*, one of the commonest Algæ of Greenland, is very large; the stalk, which is sometimes many ells * long, bears a lamina (frond) of equal size. Some specimens had been seen by Prof. Agardh, which, including both stem and frond, were eighty feet long. Ruprecht mentions an Alaria from the Sea of Okhotsk, the frond of which was about the same breadth as that of the common European form, which had a length of more than fifty feet. From Spitzbergen comes another species of this genus, whose frond is as much as one ell in length and about three ells long; and also another species several ells long, with a stem as thick as a finger. But it is especially in the north part of the Pacific, on the North American coast, that the richness of the Laminarian forms and their great size are most conspicuous. The species of Alaria, Arthrothamnus, Thalassiophyllum, Agarum, and Nereocystis together constitute such a magnificent marine flora, that one feels a difficulty in forming an idea of the smaller representatives of the same group which are found in other seas. *Nereocystis Lutkeana* has a stalk 270 feet in length, when it swells into a bladder that bears a tuft of fronds which are quite twenty-seven feet in length. In the Antarctic seas the analogues are to be found, the Durvillæa, and Lessonia of Cape Horn, Ecklonia of the South African coast, the species of Macrocystis, &c., are well-known examples of the large Algæ which are found there.

It is perhaps less surprising that a rich marine flora should appear on the coast of Spitzbergen wherever a considerable branch of the water of the Gulf Stream follows the coast, and in proportion receives a higher temperature and a greater degree of saltness. But in Greenland it may be otherwise. Cold currents are said to flow along the west coast of Greenland upwards, as well as on the opposite coast of America downwards.† During a considerable portion of the year the sea appears to be frozen along the coast, and even during the summer months drift ice is reported to be continually seen in the open sea. Under such conditions, although a marine vegetation of large size appears there, it may be assumed that an ice-cold or nearly ice-cold sea by no means prevents a great development of Algæ, where the other conditions necessary for their growth are found. One is tempted to believe that the great abundance and size of the marine flora on the coasts of the colder seas, on the one hand, and on the other the richness of the open seas in Diatomaceæ, are in some measure the cause of the abundance of animal life which prevails in these regions, and which, in the regularity of its limits, may afford a hint to the expeditions for carrying on the whale fishery that every year employs thousands of vessels. "It has been remarked," says Ruprecht, "that the northern boundary of the large sea animals is found where the coast is most bare of Algæ;" and Maury ("Physical Geography of the Sea") remarks on the superior flavour of fish from the colder waters, and the greater excellence of the principal fishery grounds of the world, which are all situated in the colder waters.

In direct opposition to what occurs on the Greenland and Spitzbergen coast, Ruprecht states that the whole coast of Behring's Sea north of the Aleutian Islands is almost entirely without marine vegetation; an astonishing statement, as not only on the Aleutian Isles, but also on the American coast to the south of them, the marine flora is rich and is developed on a grand scale. Ruprecht's statement that the whole Arctic sea of Siberia, eastward from the Gulf of Kara to Behring's Sound, is almost entirely without marine vegetation, is almost open to doubt, since Prof. Agardh possesses specimens of two Algæ in good preservation which were taken near the mouth of the Lena, and Ruprecht himself mentions another Alga which was found in Behring's Sea. Should it be ascertained that while the rocks of the Arctic Sea, wherever they have been examined, namely, in Norway, Spitzbergen, Greenland, and the coasts of America, present, through the number of individuals and their great size, a peculiar marine vegetation, while, on the other hand, eastward from the Gulf of Kara the sea should be found to be very poor as regards its flora, or even desitute of these large Algæ, perhaps one might under these circumstances form an opinion that the Baltic Sea was one of the former gulfs of the Arctic Ocean, and at a later period was separated from it; hence great interest attaches to the study of the Algæ of the Baltic Sea. The character of extraordinary scarcity of Algæ, which according to Ruprecht characterises the Arctic Ocean, also prevails in the Baltic Sea, where long ranges of rocks, broken like those of the Atlantic into bays, and apparently well adapted to harbour a rich vegetation, are entirely bare of vegetation, while the rocks and rock-pools on the western coast are crowded with Algæ. The stunted representatives of marine Algæ that most generally appear in the southern and western parts of the Baltic Sea may perhaps have come at a later period from the west, after the Baltic was united with the Atlantic.

More accurate information relative to the Algæ and their alleged scarcity in the Siberian Sea and Behring's Sound are still wanting, but *à priori* one is scarcely entitled to assume that the Algæ in these localities should differ materially from the uniform character of gigantic size which seems to distinguish the vegetation of the other Arctic Sea. On the other hand, that the Baltic Sea, as well in respect of the number of individuals as of their development, is in direct opposition to the vegetation in the other northern sea, is undeniable. But the Baltic Sea is in a peculiar state. It is an enclosed sea, into which large fresh-water rivers discharge themselves, and a freezing sea, ice-covered during a considerable part of the year, in a great degree prevents evaporation. Both these circumstances may cause the Baltic to be considered almost as a fresh-water basin, into which salt water flows from the sea almost entirely through the Kattegat and more south-westerly parts, and in the deep water retains some perceptible degree of salt. The influence of the salts on the growth of Algæ is at present but little understood, but that they have great influence cannot be doubted. The Algæ which appear in the Baltic cannot be said to indicate a high northern or north-eastern origin. They seem to be the Algæ of the Kattegat in a dwarf form. Some few species of Algæ appear to be peculiar; but in this case they do not prove that the Baltic was once a gulf of the Arctic Sea.

It has been already remarked that a scarcity of forms and abundance of individuals is a characteristic of the marine vegetation of the northern ocean. Nevertheless it must not be concluded from the scarcity of forms which prevails in every separate locality, and of which a few species of each constitute the principal masses of marine vegetation, that the same species prevail everywhere. We should then fall into the error of the older botanists, who thought that they recognised in foreign Algæ many well-known forms of the European flora, which outwardly bear a great resemblance to each other. With regard to the northern Laminariæ and Fucaceæ, it may yet be shown that there are analogous—if not identical—species, which appear in different localities, and that the species resembling each other in aspect, also in their *habitat* resemble each other, and thus constitute representative species. The circumstance that at first one does not perceive the difference between species bearing similar names from different localities, is but weak evidence of the identity of the forms which under the same names were supposed to prove that all these so named European species actually appeared on the coast of Australia; although we might justly allege this fact as a proof of changes which might have broken the former connection between the seas, and so prevented migration from taking place at the present time. So soon as accurate examination is made, important variations are observed to exist between many species which pass under similar names, and some doubt may be entertained, not only whether they constitute entirely different species, but even whether they do not sometimes belong to entirely different genera.

Such representative species appear in many, and in perhaps most genera; but in Laminaria and Fucus there are some analogous forms which are very similar to the eye; there being in each genus two principal forms only, while each possesses many species which bear a great resemblance to each other. The similarity is, in reality, here so great that many were for a long time considered, and many more may probably even henceforth be considered, as modifications of the same species.

The difficulty of characterising the species of Laminaria is really very great, not only on account of the great resemblance between them, but also because the species change their aspect

* A Swedish ell is equal to two feet.—M. P. M.

† In the narrative of the North German Expedition it is stated that on the east coast of Shannon Island, lat. 75° 29′ N., drift-wood, identified as alder (*Alnus incana*, L.) and poplar (*P. tremula*, L.) was washed ashore, thus plainly showing that the drift-wood of N.E. Greenland comes originally from N. Siberia; whence, driven into the sea by the strong currents, it floats in a westerly direction north of Spitzbergen, and is carried on until it reaches Greenland, where it takes a southerly course. See vol. ii. p. 537.—M.P.M.

during different periods of their development, and this more frequently in an analogous manner. During the first period they are so like each other that it is almost impossible to separate one from the other the younger forms of the most dissimilar species. They all begin with a short stalk and an undivided frond (lamina); then the stalk continues short in some, and lengthens considerably in others; in some the lamina continues undivided; in others it is cloven. But it is especially to be observed that this lamina, whether undivided or cloven, is variable in most species. Thus, all are at first small and extended in length, with a more or less wedge-like base; but the wedge-like base becomes heart-shaped and even kidney-shaped in some; in others it retains a wedge-like form throughout its whole state of development. Most species periodically change their lamina; with the change the new lamina becomes larger and broader than the old one. The young lamina is thin; in colour rather inclining to green than to light brown; in different species the lamina is at a later period thinner or thicker, and with a different tint of colour. The fructification appears in different species not only in different parts of the lamina, but the sori extend in different directions, although they do not seem to assume precise forms. The characteristics of species must therefore be judged, not from the peculiarities of appearance, but by the whole development of the plant, the differences of which are with difficulty comprehended, unless the species throughout their whole range of growth be accurately compared with each other. Considering that certain characteristics are scarcely perceptible except when the plants are in fresh condition, and that collectors are contented with preserving portions or incomplete specimens only, we cannot wonder that the species of Laminaria should be confounded with each other.

Greville had named a Laminaria from the coast of Africa, *L. pallida*, from a modification in its colour. Younger forms, in which the colour was less evident, or the lamina not yet cloven, were referred by many algologists sometimes to *L. digitata*, sometimes to *L. saccharina*. But between these northern species and that of the Cape, lies an ocean which it is difficult for a Laminaria to pass. Although the characters which separate *L. pallida* and *L digitata* are not more important than those which separate *L. digitata* from *L. stenophylla*, it must, nevertheless, be considered that *L. pallida* is a distinct species.

L. longicruris is the most common as well as the largest of the Greenland Laminariæ. It is the representative on their coast of *L. caperata*, a native of Spitzbergen, no specimens of which have been seen from Greenland, neither has *L. longicruris* yet been found at Spitzbergen. From Greenland *L. longicruris* spreads down the American coast as far at least as the forty-second parallel, and one specimen is reported from the Bahamas. Portions of this species have been cast ashore on the coasts of Norway, Ireland, and Scotland. In Gunner's "Flora Norvegica," a form is mentioned under the name of *Ulva maxima*, which Agardh considers to be *L. caperata*; the same form has also been found on the north coast of Scotland.

The Berggren collection also contained a great number of examples of Laminaria that, by Dickie (Algæ from Cumberland Sound, in Linn. Soc. Journ. vol. ix. p. 237) and by Croall (in Brown's "Flora Discoana," Trans. Bot. Soc. Edinb. p. 459), was called *L. saccharina*. Prof. Agardh considers the above-mentioned plant as identical with his *L. cuneifolia*. He states that he has never seen a specimen from Greenland of *L saccharina* as it appears on our coast. *L. cuneifolia* is an example of a species which is found near Greenland and also in the northern part of the Pacific. The Alga described by Ruprecht under the name of *L. saccharina v. lessoniæfolia* may be a smaller form of the same species. Specimens from Newfoundland and Scotland have been seen, which may belong to the same species.*

Of *L. solidungula* there are specimens from Ritterbank and Jakobshavn. This species seems to have a wide range in the Arctic sea, appearing at Spitzbergen, Greenland, and in the northern parts of the Pacific, if, under this species, is to be accepted some specimens with disciform roots described by Ruprecht.

In the same collection is a new species with laciniated frond, named *L. atro-fulva* from its dark colour, which distinguishes it from every other species, in all stages of its growth. Excepting *L nigripes*, it is the only Laminaria from Greenland with a laciniated frond. Neither Dickie nor Croall mentions it in their lists of Algæ. In a note to the Flora Discoana it is mentioned that in another collection *L. digitata* was found. From such a statement one may, nevertheless, be unable to determine which Laminaria with laciniated lamina was here referred to. That *L. digitata*, so common on the European and Spitzbergen coasts, should not be found in Greenland was so much the more singular, that it was thought to be common at Newfoundland, and is stated by Harvey to appear on the American coast as far south as Cape Cod. Postel and Ruprecht also mention it as existing in the North Pacific, but perhaps the specimens seen belong to other species. *L. Bongardiana*, with which *L. atro-fulva* most nearly agrees, is said to have a canaliculated stem, by which it is easily separated from the Greenland species.

Of *L. dermatodea* there is only one specimen in this collection. It is probably rare in Greenland. This species is found at Newfoundland, Spitzbergen, and Norway.

L. Fascia is included in the Berggren collection, but is not met with at Spitzbergen.*

A Greenland specimen, called *Scytosiphon filum*, was in a state of preservation too imperfect to be determined.

The most beautiful and characteristic species of the Greenland marine flora are, undoubtedly, those of Agarum, a genus which belongs also to the northern part of the Pacific. The Greenland species extend down the North American coast and that of Newfoundland, but not a fragment of this genus has as yet been found on the Spitzbergen and European coasts. It appears to be common in Greenland. The Greenland species vary in the breadth of the costa and the closeness of the holes with which the frond is pierced, but Agardh knows of no other difference, and refers all the specimens to one species, namely, *A. Turneri*.

Among the Laminariæ, included in the collection, few are of greater interest than the form of Alaria taken in Sukkertoppen in great abundance and of all ages. Hence Prof. Agardh has been able to characterise the different Greenland species of Alaria, which are as follow:—*A. esculenta*, *A. musæfolia*, *A. Pylaii*, *A. membranacea*, and *A. grandifolia*.

Next to the Laminariæ the Fucaceæ form the most considerable part of the Berggren collection. They consist chiefly of the more Arctic forms brought home from Spitzbergen, with some differences. Of the forms common on the north coast of Europe (*Fucodium canaliculatum*, *Fucus serratus*, *Halidrys siliquosa*) which have not been found on the coast of Newfoundland or America, there are not any examples in the Greenland collection. Of these, *F. serratus* only is found at Spitzbergen, but this differs from the true European form. With *F. serratus* may be compared *F. edentatus* of Newfoundland. *F. canaliculatum* was compared by Harvey with *F. fastigiatum* of California. Analogous species probably represent each other in different localities. Of *Fucodium nodosum*, some examples, taken from different localities, are found in the Greenland collection.

Fucus vesiculosus, so common along the European coast even up to the extreme north of Norway, is absent, or at least very scarce, at Spitzbergen, but is one of the commonest of the Greenland species. It is found there both with and without vesicles. Besides *F. vesiculosus*, the collection contains numerous examples of *F. evanescens*, J. Ag., *F. Miclonensis*, and *F. filiformis*, which grow together, and in the same locality as *F. vesiculosus*, which is distinguished from the others by its stout consistence and by its drier surface, while the others give out more mucus. It is also easy to separate extreme forms of *F. evanescens*, *F. Miclonensis*, and *F. filiformis*, but among the abundance of specimens brought from Greenland intermediate forms appear, so that it is often difficult to decide the boundary between these species. When extreme forms lie together, *F. filiformis*, so different in its aspect from *F. evanescens*, is without doubt much more nearly related to *F. evanescens* than to *F. distichus*, with which it has long been confounded and considered identical.

Among the Greenland collection is one which differs from any that Prof. Agardh had seen, but which agrees most nearly with *F. filiformis*, although it is separated by fixed characters from all the species previously received. The smallest forms come nearest to *F. balticus*, like that forming globular vesicles which probably float the plant with ease into deeper water. It has been named *F. divergens*.

The fact that the species of Fucus, more than those of various

* Near Walrus Island, lat. 74° N, great quantities of marine plants, chiefly consisting of a large Laminaria, were washed up by the ice and the tide, or were lying in hollows. See Narrative of North German Expedition, vol. ii. p. 518.—M. P. M.

*In the narrative of the German Arctic Expedition (vol. ii, p. 345) *L. Phyllitis* is stated to have been found all along the East Greenland coast among and under the ice. This is the first time I believe that this Alga has been reported from so high a latitude. It was accompanied by *Desmarestia aculeata*.—M. P. M.

other genera, appear to be formed upon a single type, contributes naturally to the common opinion that the genus has few but much-varying species. In describing the Greenland forms, Prof. Agardh has endeavoured to show that besides the difference in form, deviations also occur which ought to be retained as characteristics. In a preceding memoir he had stated that the differences noticed by other algologists in the antheridia and spores being formed in the same or in separate receptacles may possibly be explained thus: namely, that in different seasons the receptacles differ in this respect. Should such an explanation prove to be erroneous, it will undoubtedly be seen that it is these differences, more than others, that deserve to be considered as the characteristics of species.

The reader who wishes for further information relative to the species of Algæ inhabiting the Arctic seas is referred to the list of Arctic Algæ in Harvey's Ner. Bor. Americana, and to Dr. Dickie's List of Algæ obtained in Cumberland Sound (Journal of Linn. Soc. vol. ix.) Perhaps also some of the Algæ collected by Dr. Lyall on the north-west coast of America, thirty-two of which had not been found elsewhere, may extend to the Arctic Sea. See Harvey's List of Algæ, collected by Dr. Lyall, Journ. of Linn. Soc. vol. vi.

MARY P. MERRIFIELD.

SCIENTIFIC SERIALS

American Journal of Science and Arts, April.—The principal contents of this number are: The history of Young's discovery of his theory of colours, by Alfred M. Mayer. The aim of this paper is to give extracts from Newton, Young, and Wollaston, which embody the early literature of Young's celebrated theory of colour, and to furnish a history of the steps by which he was led to the adoption of what is now known as Young's theory of colour-sensation.—A re-determination of the constants of the law connecting the pitch of a sound with the duration of its residual sensation, by Alfred M. Mayer. This article refers to a previous article of October 1874 on the same subject. Since then, Madame Seiler (who assisted Helmholtz) and Dr. Carl Seiler have spent considerable time in re-determining the durations of the residual sonorous sensations, using Mr. Mayer's apparatus. From their experiments he has found the law given before as $D = \left(\frac{53248}{N + 23} + 24\right)\cdot 0001$ requires to be modified to $D = \frac{3\cdot 2}{N + 31} + \cdot 0022$, where $D =$ the durations of the residual sonorous sensation corresponding to N number of vibrations per second.—On the action of the less refrangible rays of light on silver, iodide, and bromide, by Carey Lea. The result of 160 very concordant experiments shows that AgBr and AgI are sensitive to all the visible rays of the spectrum. AgI is more sensitive than AgBr to all the less refrangible rays and also to white light. The sensitiveness of AgBr to the green rays was materially increased by the presence of free silver nitrate. AgBr and AgI together are more sensitive to both the green and the red rays than either AgI or AgBr separately.—On the Silurian age of the Southern Appalachians, by F. H. Bradley. First portion (to be continued).—Spectroscopic examination of gases from meteoric iron, by Arthur W. Wright. On the supposition that meteoric iron has received its hydrogen and other gases from the sun or some other body having a similar atmosphere of great density, it seemed probable that a spectroscopic examination might reveal the unknown gaseous elements assumed to be present in the solar corona. Only negative results were obtained. But the fact incidentally observed of the varying character of the oxygen and hydrogen lines in the presence of hydrogen, and the near coincidence of two of them with prominent coronal lines, with the possible coincidence of a third line, goes to show that the characteristic lines in the spectrum of the corona, so far from indicating the presence of otherwise unknown elements, are simply due to hydrogen and the gases of the air, oxygen and nitrogen.—On the duplicity of the principal star of Σ 1097, by S. W. Burnham.—The original notes under the head of Scientific Intelligence are: Progress of Geological Survey of Canada, 1873-74; the genera Opisthoptera (Meek, 1872) and Anomalodonta (Miller, 1874); the Gulf of Mexico in the Miocene time.

Der Naturforscher, Nos. 1 to 5, 1875.—This part contains many papers reprinted from other journals, besides several original contributions. We note the following:—On the physiological action of amyl nitrite and the causes of blushing; investigations made by Herr Wilhelm Filehne, who found that amyl nitrite acts upon that part of the brain which is also acted upon when the individual has the feeling of shame and blushes. The most interesting part of the paper is the description of the effects of amyl nitrite upon animals; accelerated breathing and palpitations were the result, evidently similar to the physiological phenomenon in man. In the latter case, whether produced by the ether or by psychic emotion, the phenomenon is exactly the same.—Report on the Crustacea observed on board the *Challenger* between the Cape of Good Hope and Australia, in the Antarctic seas, by Willemoes-Suhm.—On the ascending currents of air in our atmosphere, by J. Hann.—On the finer structure of the electric organs of fish, especially of the species Torpedo, Malapterurus, and Gymnotus, by F. Bol.—On the point of combustion: a lecture delivered by A. Mitscherlich before the Chemical Section of the Association of Naturalists at Breslau.—On the fossil Cetacea of Europe, by J. F. Brandt.—On the diatoms of the coal age, by F. Castracane. The author succeeded in proving the existence of diatoms in a piece of Lancashire coal; it was powdered finely, and burnt in a stream of oxygen. The residue was treated with nitric acid and chlorate of potash, and then washed. The species he found were all sweet-water species, with the exception of a Grammatophora, a little Coscinodiscus, and an Amphipleura, and comprised the following:—*Fragilaria Harrisonii*, Sm.; *Epithemia gibba*, Ehrbg.; *Sphenella glacialis*, Kz.; *Gomphonema capitatum*, Ehrbg.; *Nitzschia curvula*, Kz.; *Cymbella scotica*, Sm.; *Synedra vitrea*, Kz.; and *Diatoma vulgare*, Bory.—On the Chætopoda of the Atlantic, by E. Ehlers; account of the results of a collection made on board the *Porcupine* in 1869.—Studies on the diameter of the sun, by P. Rosa. These studies were published after the death of the author, by Fathers Secchi and Ferrari, and contain many interesting details which are well worth the attention of astronomers.—On the absorption spectra of some yellow vegetable colouring matters, by N. Pringsheim. The result of these investigations seems to be that these colouring matters are merely modifications of chlorophyll, and that there exist numerous modifications of this substance, from the brightest yellow to the darkest green.—On the influence of the concentration of blood upon the motion of the blood-corpuscles.

SOCIETIES AND ACADEMIES

LONDON

Physical Society, May 8.—Prof. Gladstone, F.R.S., president, in the chair.—Mr. Crookes, F.R.S., exhibited and described some very important experiments on attraction and repulsion resulting from radiation, which he has recently submitted to the Royal Society, and of which an account has already been given in this journal (vol. xi. p. 494). It is unnecessary therefore to describe them at length, but it may be pointed out that the most beautiful of the instruments is one which Mr. Crookes calls a radiometer. It consists of four arms suspended on a steel point resting in a cup so that they are capable of revolving horizontally. To the extremity of each arm is fastened a thin disc of pith, lampblacked on one side, the black and white faces alternating. The whole is enclosed in a glass globe, which is then exhausted as perfectly as possible and hermetically sealed. Several of these instruments varying in delicacy were exhibited, and experiments made showing the influence of light and heat of different degrees of refrangibility, and in proof of the law of inverse squares, &c.—The President, in expressing the cordial thanks of the Society, referred to Mr. Crookes' statement that the repulsion was proportional to the length of the vibrations, and asked whether at the red end of the spectrum there was an abrupt termination of the action, and a gradual diminution towards the ultra violet.—Mr. Walenn inquired as to the action of the magnet and of different axes of crystals in causing repulsion.—Prof. Woodward made some observations with reference to the manipulation.—Prof. Guthrie paid a graceful compliment to Mr. Crookes' work, and observed that researches might be divided into two classes; those in which the value of the work outweighed the merit of the author, and those in which a result of comparatively trifling significance is the outcome of years of patient labour. He expressed a strong conviction that Mr. Crookes' research had, in an almost unparalleled degree, both elements of greatness.—Mr. Crookes stated, in reply to Dr. Gladstone's question, that the glass envelope of the radiometer

must be taken into account in considering the action of the rays of different refrangibility, and further, that the increased effect due to red light may have been in part due to the concentration of rays of low refrangibility which attends the use of glass prisms. A diffraction spectrum might give a different result. He added that when a ray falls on a surface capable of motion, which reflects it, very little work is done, but if the surface quenches the ray, motion is produced. He then thanked Prof. Guthrie for his kindly remarks.—Prof. Cornu, of the École Polytechnique, described his recent experiments on the determination of the velocity of light. He gave an account of the method of Foucault, and exhibited the complete apparatus, including the arrangement of mirrors for multiplying the distance traversed between the two reflections from the revolving mirror (NATURE, vol. xi. p. 274).—Prof. Adams, vice-president, mentioned that M. Cornu had contributed in no small measure to the success which had attended the formation in France of a society closely corresponding to our British Association, and assured him that the Physical Society felt grateful for his presence, as he could well understand the difficulties with which the early days of such a society are beset.—M. Cornu stated, in answer to a question of Prof. G. C. Foster, that he objected to the revolving mirror method, because the distance to be traversed by the light was very small, and because the path of the ray lay through a vortex of air produced by the rapid revolution of the mirror.

Royal Horticultural Society, April 7.—Scientific Committee. A. Grote, F.L.S., in the chair.—A communication was read from W. Wilson Saunders, F.R.S., describing a diseased condition of young poplars planted on the sides of roads in East Worthing. The disease seems sooner or later to be fatal to the tree, for he had not seen one tree attacked of which there seems any chance of recovery. The trees are from twelve to eighteen feet high, and with stems varying from five to seven inches in diameter. The disease is most apparent in large, rough, open wounds about the commencement of the lower branches, and on the stem; but upon closer examination symptoms of the disease will be found all over the tree, even to the tops of the branches. The disease seems to show itself at first by a longitudinal fissure in the bark, which fissure is nearly straight and but of little depth, having its lips slightly elevated and reflexed. At first the fissure does not penetrate the whole depth of the bark, but, gradually deepening and extending in length, the wood becomes exposed. This continues until the wood is quite exposed, and in a branch of two years' growth the disease assumes the appearance of a long open wound, exposing much of the wood which the growth of the bark partially covers up. Tracing the progress of the disease further, side fissures will be seen producing the same results; and these fissures, running one into the other, break up the bark until occasionally the disease extends all round the branch. When a branch gets diseased, the portion above the wound dies. The disease is often slow in progress, particularly when on the main stem, large open wounds then appear, of the same character as those on the branches, exposing much of the wood, but having the surrounding bark, although diseased and cracked, in a healthier state.—Mr. M'Lachlan referred to a note in the report of Lieut. Carpenter, of the American Geological Survey, in which it was stated that the Colorado Potato Beetle was distributed by means of seed potatoes, and that its absence in Utah and other parts of California was to be attributed to the fact that it has not yet been necessary to import seed potatoes.—Mr. Hemsley sent a turnip with a cavity in the interior of the root nearly filled by leaves growing from the crown downwards and inwards.—Prof. Thiselton Dyer exhibited under the microscope a portion of the plasmodium of *Æthalium*, showing the "streaming" movements of the protoplasm of which it is composed.

General Meeting.—W. Burnley Hume in the chair.—The Rev. M. J. Berkeley commented on the objects exhibited, including a group of species of *Drosera* and *Drosophyllum* exhibited by Messrs. Veitch.

April 21.—Scientific Committee.—Andrew Murray, F.L.S., in the chair.—The Chairman remarked that from his own observation there could be no doubt that the Colorado Potato Beetle was perfectly able to live in the climate of Canada.—Mr. Edmonds sent from the Gardens at Chiswick House a basket of *Peziza lanuginosa*.—Dr. Masters exhibited shoots of peach-trees which had been killed owing to having been thickly painted with colza oil.—Mr. Wilson Saunders communicated a note on a monstrous condition of the early St. John's Cabbage. When the bed of cabbages was about at its best, a long, warm, very dry period was succeeded by much rain. The sudden impulse given to vegetation by this soon caused the solid heads of the cabbage to burst, and in a few days a series of smaller, well-shaped, rounded, compact heads were formed from the central axis of growth, closely touching each other, and backed up by the leaves of the original head, which remained green and full of sap. The number of these smaller heads varied from three to six in each cabbage.—Prof. Thiselton Dyer read an abstract from the *Sitzungsbericht der Gesellschaft Naturforschender Freunde zu Berlin* for Nov. 17, 1874, in which an account was given by Magnus of the production of graft hybrids in the potato by Reuter, the chief gardener at Potsdam, in 1874. He used the white long Mexican and the dark grey black kidney, both of which sorts had been introduced from America by the Novara Expedition. A wedge-shaped piece of the former, bearing an eye, was grafted upon the latter. The graft hybrids exhibited an intermediate character in form between the parents. They were broader and thicker than the long thin Mexican, longer than the black kidney. One of the potatoes also exhibited a blending of the colours. The two ends were red, and the middle zone a greyish yellow. The dark grey colour of the black kidney is produced by the intense red sap in a layer of cells covered by the corky rind. In a subsequent communication Magnus mentioned similar experiments which had been made by Dr. Max Heimann, and communicated to the botanical section of the *Schlesischen Gesellschaft* in the *Sitzungsbericht* for Nov. 19, 1872. Magnus described similar results obtained by Dr. Neubert, of Stuttgart, by herbaceous grafts of the stems.

General Meeting.—W. Burnley Hume in the chair.—Prof. Thiselton Dyer commented on the objects exhibited.

Anthropological Institute, May 11.—Col. A. Lane-Fox, president, in the chair.—Mr. Moncure D. Conway, M.A., read a paper on Mythology. He maintained that the evolution of mythology was the reverse of what the facts of physical evolution might suggest; it was not from beneath upwards to higher things, but rather from the grand in nature that the human mind had arrived at the association of mystical meanings with the stock and stone, plants and animals, which figured so largely in popular mythology. Sacred animals were consecrated as symbols of the higher phenomena. Flowers and plants derived their potency from connection with solar or lunar influences, still represented in the belief that to be healing they must be gathered at certain holy times or at certain phases of the moon. It was also maintained that the gods were personifications of power, and unmoral; they were gradually divided into good and evil, the demoniac powers being for a long time not diabolical, but personifications of hunger, thirst, and the dangers and impediments of life. The idea was combated that men had ever worshipped purely evil powers. The legend of Eden was held by Mr. Conway to be inexplicable by Semitic analogues. In India were found the myths of serpent-guarded trees and the apple of immortality, and the curse on the serpent which had puzzled theologians was explained by the theory of transmigration.—A paper by Rev. A. H. Sayce, M.A., was read, on Language and Race. The author held that the fallacy of language as a sure and certain test of race is one to which few modern philologists would commit themselves. There was no assertion which could be more readily confronted with history, or, when so confronted, more clearly be demonstrated to be false. Society implied language, race did not; hence, while it might be asserted that language is the test of social contact, it might be asserted with equal precision that it is not a test of race. Language could tell us nothing of race. It did not even raise a presumption that the speakers of the same language were all of the same origin. It was only necessary to look at the great States of Europe, with their mingled races and common dialects, to discover that language showed only that they had all come under the same social influences. Race in philology and race in physiology meant very different things.—Mr. A. W. Franks, F.R.S., exhibited an inscribed wooden gorget from Easter Island.

Entomological Society, May 3.—Sir Sidney Smith Saunders C.M.G., president, in the chair.—The President exhibited male specimens of *Stylops*, taken by himself in the pupa state, on *Andrena atriceps*, at Hampstead Heath, on the 6th, 9th, and 17th April last. Mr. Enoch, who had been there on the 6th at an earlier hour (between nine and ten o'clock) had been still more successful, having captured 17 males, one of which, however, was taken after 2 P.M. The President drew attention to the remarkable difference observable in the cephalothorax of the

females in these specimens, as compared with those met with on *Andrena convexiuscula*, and remarked on the importance of not confounding the species obtained from different *Andrenæ*, *Stylops Spencii* having been described from *A. atriceps*, while *S. Thwaitesii* had been described from *A. convexiuscula*. Mr. Smith believed that eventually a great many species would be found to inhabit this country, and that as many as a dozen different species would probably be found on the genus *Andrena* alone, independently of *Halictus*.—Mr. M'Lachlan read an extract from a report made to the Royal Society, on the Natural History of Kerguelen's Island, by the Rev. A. E. Eaton, who was attached as Naturalist to the Transit of Venus Expedition to the island (NATURE, vol. xii. p. 35). Nearly all the insects were remarkable for being either apterous or with greatly abbreviated wings. Mr. M'Lachlan said that the theory as to the apterous condition of the insects was that the general high winds prevailing in those regions rendered the development of wings useless; and Mr. Jenner Weir remarked that the apterous condition was correlated with the fact that plants under similar circumstances were apetalous and self-fertilising; and hence it was supposed that the existence of winged insects was unnecessary.—Mr. C. O. Waterhouse exhibited a *Chelifer* which he had discovered under the elytra of a *Passalus* from Rio Janeiro.—Mr. C. O. Waterhouse also exhibited a drawing of a Neuropterous insect of the family *Ascalaphidæ*, from Swan River, presenting the peculiarity of having a large bifid hump on the basal segment of the abdomen, dorsally, each division of the hump bearing a crest of hairs. He believed it to be the male of *Suphalasca magna*, M'Lachlan.—Mr. Wormald exhibited a collection of Coleoptera, Neuroptera, and Lepidoptera, sent by Mr. H. Pryer, from Yokohama.—Prof. Westwood communicated descriptions of some new species of short-tongued bees belonging to the genus *Nomia*, Latreille; and also a paper, on the species of *Rutelidæ* inhabiting Eastern Asia and the islands of the Eastern Archipelago.—Mr. C. O. Waterhouse communicated a description of a new species belonging to the *Lucanidæ* (*Prosopocœlus Wimberleyi*), by Major F. J. Sidney Parry; and also a description of the male of *Alcimus dilatatus*, by himself.

Royal Microscopical Society, May 5.—Mr. H. C. Sorby, F.R.S., president, in the chair.—A discussion took place upon a paper read at the last meeting by the president, upon spectrum analysis by means of the microscope, and some additional particulars of interest were furnished by the author in reply to questions addressed to him by Dr. Pigott, Dr. Matthews, Mr. Slack, and Mr. Crisp.—Mr. Slack read a paper on the relation of angular aperture to surface markings and accurate vision, in which he showed the fallacy of the present system of using high-angled objectives for these purposes to the exclusion of those of small angular aperture, and pointed out that extreme angles were only to be obtained at the expense of accurate correction and penetrating power.

CAMBRIDGE

Philosophical Society, May 3.—A communication was made by Mr. Pirie, on a method of introducing a current into a galvanometer circuit. Mr. Pirie said that electricians had often to work with currents far too strong for their galvanometer. He mentioned various methods in use for checking the swing of the needle; but contended that an easily made and easily used controller for rough work was a desideratum. He described an instrument in the form of a continuously varying shunt, in which a moving connection was obtained by a tube filled with mercury sliding on a wire of suitable resistance. This form of connection was first used by Prof. Barrett of Dublin. With the aid of Mr. Garnett, the Demonstrator of Physics, Mr. Pirie showed that a very good connection was obtained by this means; and subsequently, that the instrument described gave a control over the movements of the needle in a galvanometer whose resistance was not too different from its own.

GLASGOW

Geological Society, April 15.—Mr. James Thomson, F.G.S., vice-president, read a paper on the geology of the River Liddel, Dumfriesshire. He described several fine sections exposed along the banks of that river, showing wonderful contortions, with great "faults" and "down-throws" of strata. He also referred to the striking identity of the fossils found in a band of impure limestone in that district with those found in many parts of the Ayrshire and Lancashire coal-fields.—Mr. Thomson also read some notes on new species of carboniferous corals, giving an account of his recent investigations in that department.

BERLIN

German Chemical Society, May 10.—T. Böhm studied the influence of various salts on the growth of *Phaseolus multiflorus*, and found lime salts alone efficient for the culture of these plants.—G. Gerlich, bringing into contact sulphocyanide of potassium or of ammonium with bromide of allyl, obtained sulphocyanide of allyl when the reaction was allowed to take place at 0°, while at higher temperatures the isomeric mustard-oil prevailed.—L. Nilson has studied the selenites of beryllium, lanthanium, cerium, didymium, yttrian, erbium, and yttrium. The former metal appeared to enter into the salt as a diad, the rest as triads; thorium as a tetrad.—V. Hæmilian has proved the presence of a considerable portion of ordinary alcohol in commercial methylic alcohol.—L. Pfaundler stated the influence various solvents have on the proportion in which a base is divided between two acids.—W. Ebstein and J. Müller have isolated the ferment contained in the liver and found its action on glycogen to disappear not only when phenol but when the trace of any acid was added.—O. Fischer has transformed methyl-anthracen into methylalizarine, $C_{15}H_{10}O_4$.—A. Ladenburg observed the action of acetic acid on diamines to consist in the formation of ethenyl compounds:

$$\underset{\text{Toluylendiamine.}}{C_7H_6(NH_2)_2} + C_2H_4O_2 = \underset{\text{Ethenyltoluylendiamine.}}{C_7H_6N_2HC_2H_3} + 2H_2O.$$

—V. Meyer and W. Michler, by treating disulphobenzolic acid with cyanide of potassium and potash, have obtained both terepthalic and isophthalic acid in the same reaction.—Drs. von Mering and Musculus, after giving large quantities of chloral to patients, have found an acid in the urine of the composition $C_7H_{12}Cl_2O_6$. They deny the decomposition of chloral into formic acid and chloroform to take place in the human system.—P. T. Austin, treating chloronitrobenzol $C_6H_3(NO_2)_2Cl$ with ethylate of sodium, has obtained the ether $C_6H_3(NO_2)_2OC_2H_4$.—A. W. Hofmann has observed the following reaction of cyanogen on mercaptans $RSH + CN_2 = CNH + R - S - C = N$. Where R is $= C_3H_5$ allyl, the sulpho-cyanide is first obtained, which at ordinary temperatures passes into the isomerical oil of mustard.—R. Lussy has been able to combine one molecule of toluylene-diamine with two molecules of phenyl-iso-sulphocyanate. The compound diphenyl-toluylen-sulphurea, when treated with hydrochloric acid, yields aniline and the mustard-oil of toluylene $C_7H_6''(NCS)_2$.

BOOKS AND PAMPHLETS RECEIVED

BRITISH.—A Sketch of Philosophy: J. G. Macvicar, LL.D., D.D. (Wm. Blackwood and Sons).—Wanderings in the Interior of New Guinea: Capt. J. A. Lawson (Chapman and Hall).—The Chemistry of Light and Photography in its applications to Art, Science, and Industry: Dr. Hermann Vogel (H. S. King and Co.)—Fourth (December 1872 to December 1873) and Fifth (December 1873 to December 1874) Annual Reports of the Wellington College Natural Science Society.—Vestiges of the Molten Globe: William Lowthian Green (E. Stanford).—The Native Races of the Pacific States. Vol. ii.: Hubert Howe Bancroft (Longmans).—The Province of Psychology—the Inaugural Address at the First Meeting, April 14, 1875, of the Psychological Society of Great Britain, by the President, Mr. Serjeant Cox.—On the Distribution of Rain over the British Isles during the Year 1874. Compiled by G. J. Symons, F.R.B.S. (E. Stanford).

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